Project ICON

Research in Image Management and Access

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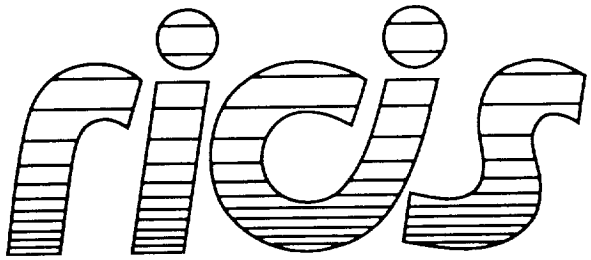
NASA Johnson Space Center
Information Systems Directorate



Research Institute for Computing and Information Systems
University of Houston-Clear Lake

DELIVERABLES

The RICIS Concept

The University of Houston-Clear Lake established the Research Institute for Computing and Information Systems (RICIS) in 1986 to encourage the NASA Johnson Space Center (JSC) and local industry to actively support research in the computing and information sciences. As part of this endeavor, UHCL proposed a partnership with JSC to jointly define and manage an integrated program of research in advanced data processing technology needed for JSC's main missions, including administrative, engineering and science responsibilities. JSC agreed and entered into a continuing cooperative agreement with UHCL beginning in May 1986, to jointly plan and execute such research through RICIS. Additionally, under Cooperative Agreement NCC 9-16, computing and educational facilities are shared by the two institutions to conduct the research.

The UHCL/RICIS mission is to conduct, coordinate, and disseminate research and professional level education in computing and information systems to serve the needs of the government, industry, community and academia. RICIS combines resources of UHCL and its gateway affiliates to research and develop materials, prototypes and publications on topics of mutual interest to its sponsors and researchers. Within UHCL, the mission is being implemented through interdisciplinary involvement of faculty and students from each of the four schools: Business and Public Administration, Education, Human Sciences and Humanities, and Natural and Applied Sciences. RICIS also collaborates with industry in a companion program. This program is focused on serving the research and advanced development needs of industry.

Moreover, UHCL established relationships with other universities and research organizations, having common research interests, to provide additional sources of expertise to conduct needed research. For example, UHCL has entered into a special partnership with Texas A&M University to help oversee RICIS research and education programs, while other research organizations are involved via the "gateway" concept.

A major role of RICIS then is to find the best match of sponsors, researchers and research objectives to advance knowledge in the computing and information sciences. RICIS, working jointly with its sponsors, advises on research needs, recommends principals for conducting the research, provides technical and administrative support to coordinate the research and integrates technical results into the goals of UHCL, NASA/JSC and industry.

RICIS Preface

This research was conducted under auspices of the Research Institute for Computing and Information Systems by Raymond F. Vondran, Principal Investigator, and Billy J. Barron, Project Director, of the University of North Texas. Dr. Charles Hardwick served as RICIS research coordinator.

Funding was provided by the Information Systems Directorate, NASA/JSC through Cooperative Agreement NCC 9-16 between the NASA Johnson Space Center and the University of Houston-Clear Lake. The NASA research coordinator for this activity was Mark Rorvig of the Information Systems Directorate, NASA/JSC.

ON THE NET: DESIGN GUIDELINES FOR INTERFACES TO LIBRARY SYSTEMS

I. Introduction

It must have been the devil that said of library systems: users need be able only to find documents, and then to view them... (Likewise, so said the same devil of automobiles "Users need be able only to accelerate, stop, and steer!)" There is a tendency to forget that technology does not leap overnight from functional capability to intuitve operation. The features of operation of automobiles, for example, have become so standard that despite dozens of models built in many countries, someone may rent one and operate it with accuracy in a matter of moments (Schneiderman, 1987, p.4). Library systems have not begun to approach this standard of intuitive use, more than likely because the basic power of computational platforms has continuously expanded by an order of magnitude in every decade since the early 1950's.

In all respects, online library access mechanisms have been altered by this growth in computational power. Only a few years ago, the prospect of inquiry into millions of records with natural language queries with immediate receipt of a ranked response was incomprehensible. Indeed, even such a basic query mechanism as boolean logic was at one time dictated only by such limits of power. Indeed, Boolean logic became a standard search algorithm because it functioned simultaneously as a mathematical expression of search parameters as well as a linguistic expression of search domains (Reintjes, 1986).

Presently, the problem of over-all library system design has been compounded by the accretion of both function and structure to a basic framework of requirements. While more device power has led to increased functionality, opportunities for reducing system complexity at the user interface level have not always been pursued with equal zeal. The purpose of this book is therefore to set forth and examine these opportunities, within the general framework of human factors research in man-machine interfaces.

As Illustration 1 below represents, human factors may be viewed as a series of trade-off decisions among four polarized objectives: Machine resources and user specifications; functionality and user requirements.

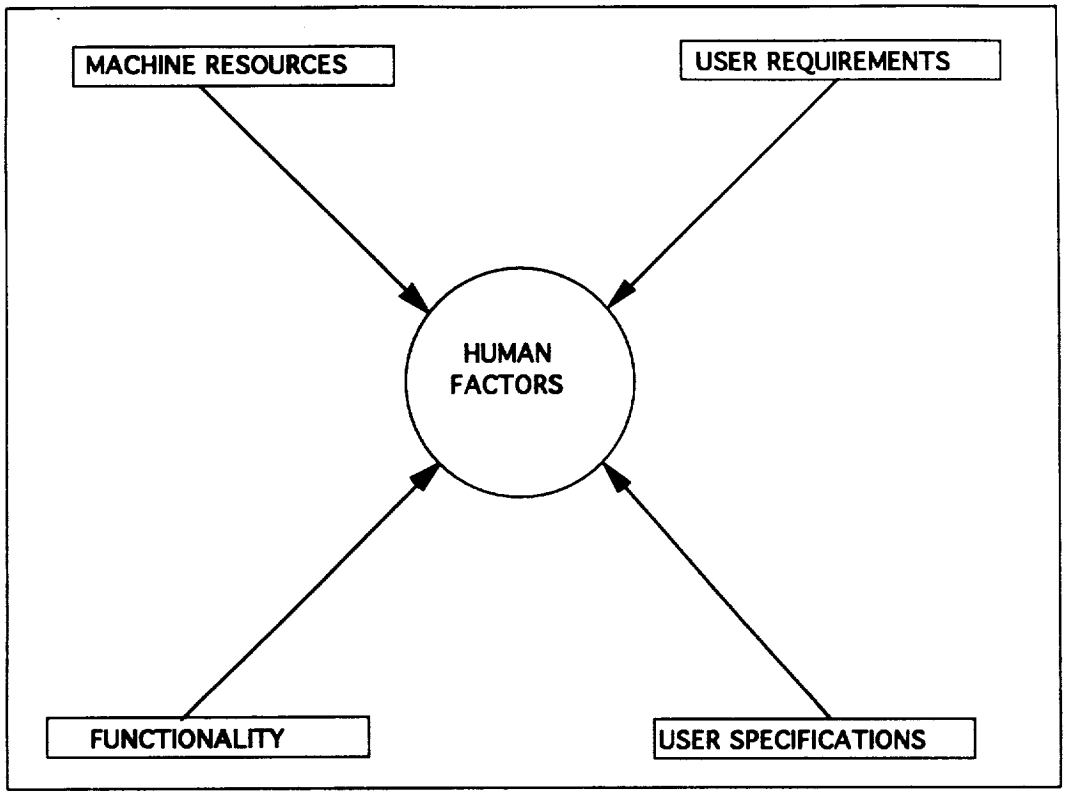


Illustration 1: A representation of human factors as a series of compromises among four objectives.

Although this characterization is not especially unique, for this research, its method of operationalization is unique. A limiting factor for all these projects in the past was the availability of systems to study. It is not usually possible, for example, to assemble a mix of locally built, vendor supplied, and hybrid (local and commerical system combinations) systems in one location. Both market forces and geographic dispersion dictate against it. However, in the last two years, over one hundred libraries supported by many different software configurations have been added to the Internet.

Internet is a collection of computational devices linked by common communication protocols and supported by the National Science Foundation. Internet history (Bowers, et al., 1990), Internet libraries (Farley, 1991), and access to libraries through Internet (Barron, 1991), have all been addressed elsewhere, and indeed, a journal devoted to Internet and related topics is now in its second year

CONFIGURATION DERIVED IN 3 DIMENSIONS

STIMULUS COORDINATES

STIMULUS NUMBER	STIMULUS NAME	PLOT SYMBOL	DIMENSION 1	2	3	
1	AB NOTIS	1	1.2921	0.7152	1.0001	Auburn
2	BN TOMUS	2	1.1303	-0.0123	1.2917	Boston
3	BU NOTIS/BLCMP	3	0.6221	1.4320	-1.2050	BYU
4	CB INV	4	-0.5130	-1.9106	-0.2837	Colby
5	CU NOTIS	5	1.3243	-1.3708	-0.7147	Clemson
6	DM Z39.58	6	1.4840	-0.6110	-0.0123	Dartmouth
7	ID NOTIS	7	0.6684	1.5585	0.5457	Indiana
8	LC	8	-0.8420	0.9888	1.0828	Library of Congress
9	LT$	9	-1.6088	-0.6022	-0.0080	Latrobe
10	LU GEAC	A	-0.3404	-1.9089	0.0862	Leigh University
11	MR	B	-0.7051	1.6703	0.5412	Merritt
12	MT	C	-0.3007	0.6717	-1.7260	Monterey
13	MY	D	-1.4621	-0.4721	-0.6192	Maryland
14	NM VTLS	E	-1.8682	-0.0158	-0.7148	New Mexico State
15	OB GEAC	F	-0.9217	0.2123	1.6575	Oberland
16	OT GEAC	G	-0.9939	1.5530	-0.1035	Ontario
17	RF	H	-1.4144	-0.6180	1.1063	Rockefeller
18	UB NOTIS	I	-0.9258	0.1633	-1.4531	Univ of Buffalo
19	UC [redacted]	J	0.0147	-1.0794	1.2698	Cal State Univ of Cal.
20	UD NOTIS	K	1.1191	-0.7306	0.0797	Univ of Delaware
21	UM NOTIS	L	1.6662	0.7390	0.2679	Univ of Minnesota
22	UN VTLS	M	-1.4817	0.8114	-0.4781	UNT
23	UO INV	N	-0.6562	-0.7033	1.3528	Univ of Oregon
24	US GEAC/[redacted]BUCAT	O	0.9421	-1.0547	-0.9638	Univ of Saskatchewan
25	UT	P	0.9956	0.2422	0.8305	UT Austin
26	UU INV	Q	0.8542	0.0395	-1.4096	Univ of Nevada @ Las Vegas
27	VA VTLS	R	0.3299	-0.3536	-1.4134	Virg. Tech
28	WU NOTIS	S	0.9067	0.3435	-0.7446	Washington University
29	WW BLCMP	T	0.6840	0.3025	0.7379	Warwick

CONFIGURATION DERIVED IN 3 DIMENSIONS

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5	CU	5	1.3243	-1.3708	-0.7147
6	DM	6	1.4840	-0.6110	-0.0123
7	ID	7	0.6684	1.5585	0.5457
8	LC	8	-0.8420	0.9888	1.0828
9	LT$	9	-1.6088	-0.6022	-0.0080
10	LU	A	-0.3404	-1.9089	0.0862
11	MR	B	-0.7051	1.6703	0.5412
12	MT	C	-0.3007	0.6717	-1.7260
13	MY	D	-1.4621	-0.4721	-0.6192
14	NM	E	-1.8682	-0.0158	-0.7148
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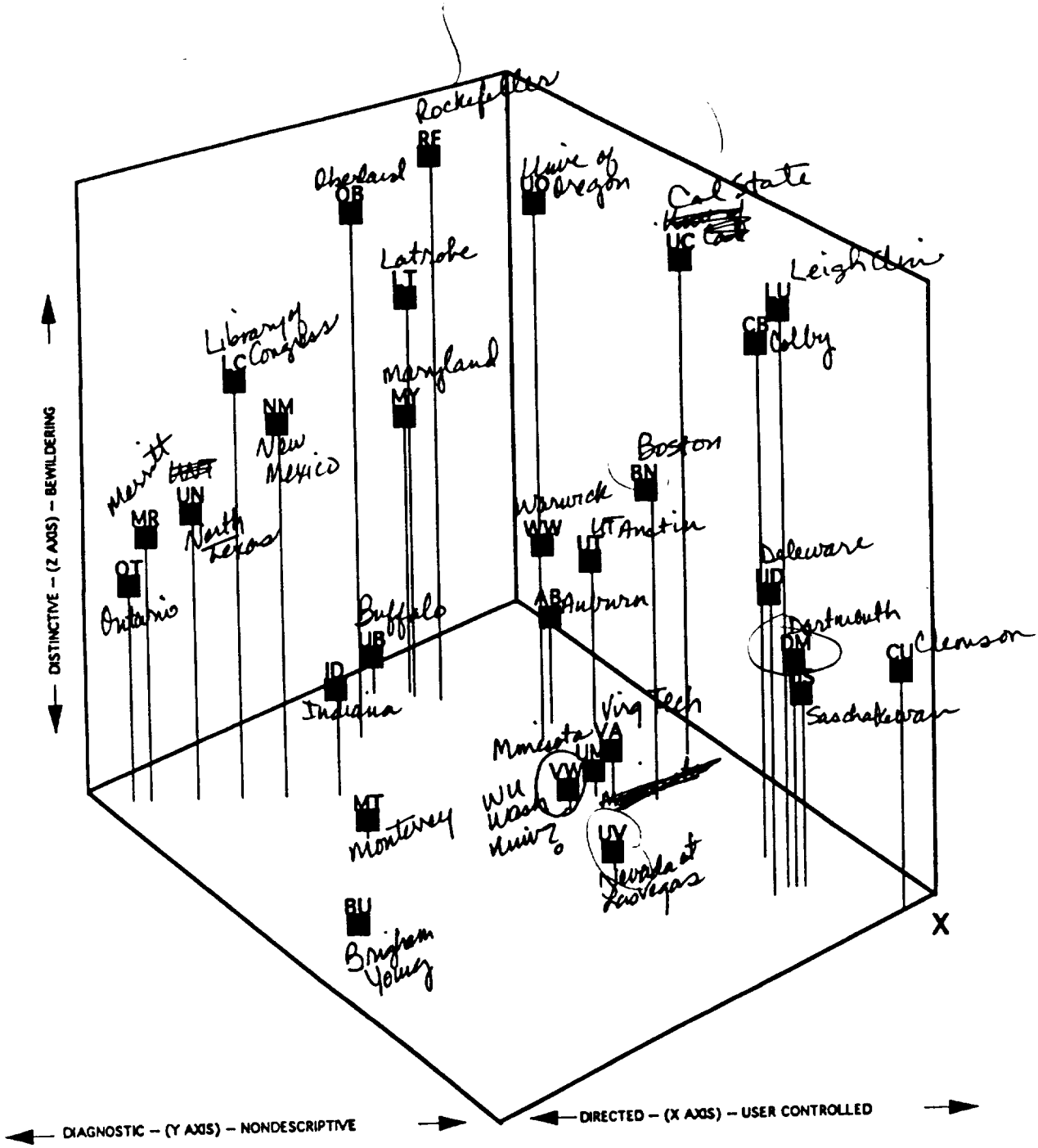
23	UO	N	-0.6562	-0.7033	1.3528
24	US	O	0.9421	-1.0547	-0.9638
25	UT	P	0.9956	0.2422	0.8305
26	UV	Q	0.8542	0.0395	-1.4096
27	VA	R	0.3299	-0.3536	-1.4134
28	WU	S	0.9067	0.3435	-0.7446
29	WW	T	0.6840	0.3025	0.7379


Rockefeller
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Library of Congress
LC
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NM
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Merritt
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MR
OT
Ontario
Buffalo
UB
ID
Indiana
MT
Monterey
BU
Brigham Young
Univ of Oregon
UO
Cal State
UC
Leigh
LU
CB
Colby
Boston
BN
Warwick
WW
UT Austin
AB
Auburn
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Dartmouth
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Clemson
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Saskatchewan
Virg Tech
VA
Montana
UM
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X
DISTINCTIVE – (Z AXIS) – BEWILDERING
DIAGNOSTIC – (Y AXIS) – NONDESCRIPTIVE
DIRECTED – (X AXIS) – USER CONTROLLED

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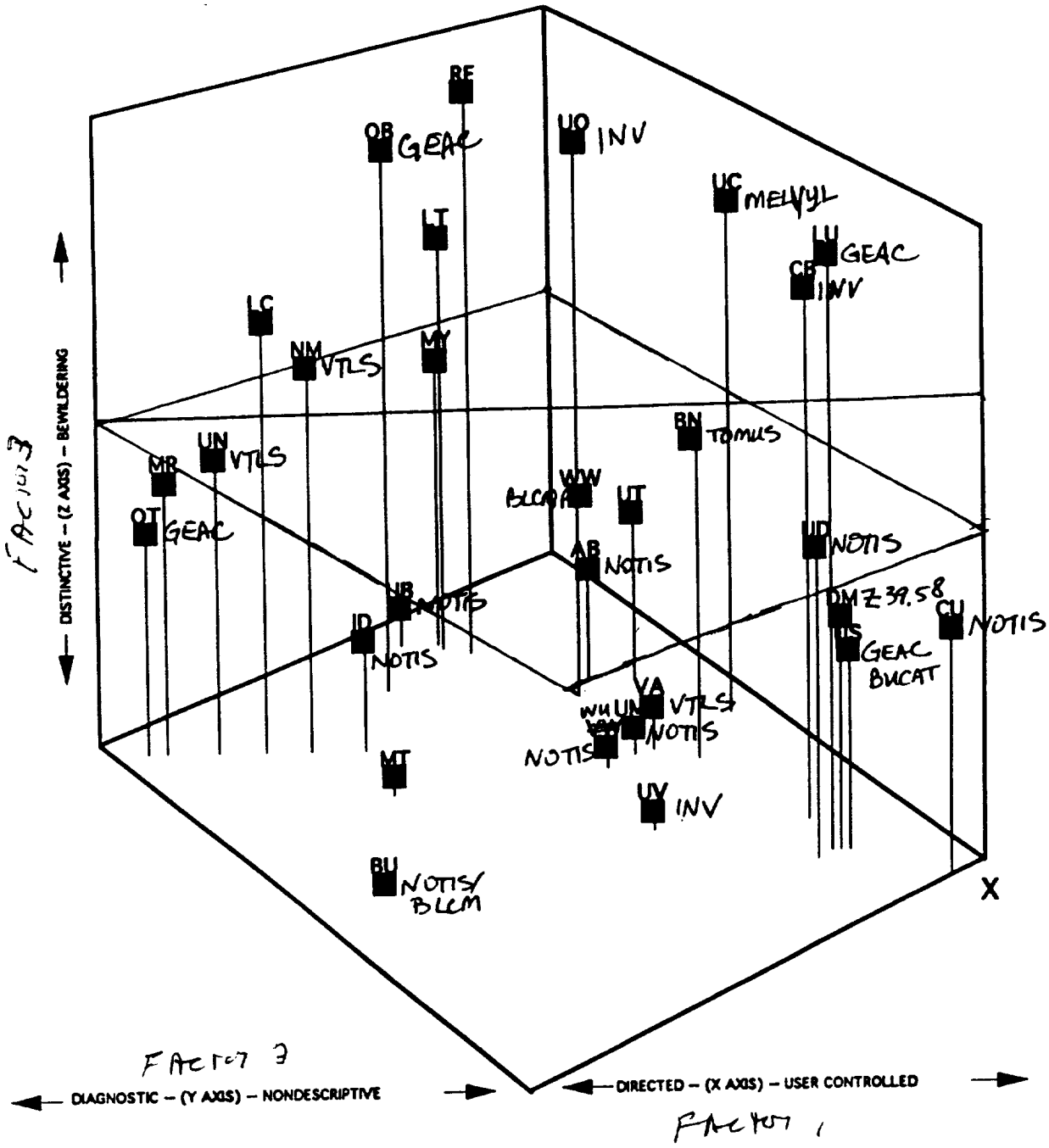
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X
FACTOR 3
DISTINCTIVE – (Z AXIS) – BEWILDERING
DIAGNOSTIC – (Y AXIS) – NONDESCRIPTIVE
DIRECTED – (X AXIS) – USER CONTROLLED
FACTOR 1

A Statistical Analysis of Human Responses to Five Internet Library Systems by Key Features

Introduction

Our statistical approach to evaluating library online catalogs concentrated on system features deemed necessary by those using a specified system. Having selected categories for desired features and labeling them Guidance/Instruction, Menu Selection, Information Structure, Error Message, and Search and Object Manipulation Functions, we identified sixty-nine key features for library systems (Chapter 4). We theorized that these groupings and the related features would be necessary in an ideal library online catalog system. To test this theory, we used a standardized questionnaire originally developed by Ben Schneiderman and modified to represent these identified key features and feature groupings and asked 110 human subjects to test five divergent systems. Statistical procedures using the statistical software package, Statistical Analysis System (SAS) were conducted to determine user satisfaction with the system and to determine the relative importance of the key features with satisfaction.

Methodology

In order to control for test bias, we deemed it important that the survey instrument be administered to a homogeneous sample. College students provided a convenient sample. Therefore, three undergraduate education classes at the University of North Texas were given the survey instrument. Each person had one week to complete the survey.

Since it was important that the differences of the systems be measured rather than the differences due to the sample population, education classes that were homogeneous in their demographic characteristics were chosen for the sample group.

Prior to completing the survey, the instructor reviewed the survey and terms and answered any questions at that time. Lab assistants provided assistance with the actual Internet login procedure but did not assist with the survey itself.

The sample population consisted of 110 participants: 87 female (80%) and 23 male (20%). Twenty-five percent of the participants surveyed were freshmen, 28% were sophomores, 33% were juniors, 9% were seniors, and 5% were graduate students. Grade levels were given a numeric equivalent with freshmen being 1 and graduate students being 5. The grade level means and standard deviations for the schools surveyed are shown in Table 1.

Grade Level of Participants

School	Mean	Standard Deviation
Boston University	2.2857	1.056
Cal State - Melvyl	2.4815	1.122
Dartmouth	2.5714	1.076
Rockefeller	2.3478	1.229
Univ. Nevada at LV	2.4444	1.199

Table 1

The age of the participants ranged from 18 to 43 with the largest concentration being in the 19 - 21 age group. The means and standard deviations for age are shown in Table 2. The participants were randomly assigned different systems to survey. There was a fairly even distribution of surveys for each system.

Age of Participants

School	Mean	Standard Deviation
Boston University	20.238	1.947
Cal State - Melvyl	21.889	4.577
Dartmouth	20.667	2.288
Rockefeller	22.348	5.399
Univ. Nevada at LV	22.444	6.214

Table 2

In order to reduce the potential for 'halo effect', the survey used different adjectives on each question and it required the participant to write in the number at the beginning of the question. The survey is shown in Table 3.

Name:_____

Age:_____

Gender:_____

College Classification:_____

Number of books by Author (your name):_____

Number of books by Author Poe, Edgar Allan:_____

UNIVERSITY OF NEVADA LAS VEGAS

At COE Menu in MH 309, press ESC
At H:>type TELNET LIBRARY.LV-LIB.NEVADA.EDU
At the login: prompt, type LIBRARY
Select V for type of terminal
Enter Y to confirm
To logoff: enter the letter D

Search the library catalog for:

Author by your name

Author by Poe, Edgar Allan

While searching, rate the following :

SCALE 0 1 2 3 4 5 6 7

_____Use by different levels of experience	Not accommodated	Accommodated
_____User can tailor the interface	With difficulty	Conveniently
_____Human memory limitations	Overwhelmed	Are respected
_____Instructions describing task	Confusing	Clear
_____Instructions for commands/choices	Confusing	Clear
_____Instructions for correcting errors	Confusing	Clear
_____Instructions for getting more help	Confusing	Clear
_____Instructions are consistent	Never	Always
_____Informative feedback is appropriate	Never	Always
_____Amount of feedback	Too little	Too much
_____Amount of feedback is user controlled	Never	Always
_____Terminology relates to task domain	Distantly	Closely
_____Terms on the screen are	Ambiguous	Precise
_____Abbreviations are	Confusing	Clear
_____Meaningful prompts	Not provided	Provided
_____Online help	Confusing	Simple
_____Accessing online help	Complex	Simple
_____Organization of online help	Confusing	Simple
_____Contents of online help	Confusing	Clear
_____Error messages are helpful	Never	Always
_____Error message clarifies problem	Never	Always
_____Error message indicates actions to be taken	Never	Always
_____Error messages are specific	Never	Always
_____Error messages are	Nasty	Pleasing
_____Error correction is	Confusing	Clear
_____Correcting typos is	Easy	Hard

SCALE	0 1 2 3 4 5 6 7
_____Undoing operations is	Easy . . . . . Hard
_____Characters in the display are	Unreadable . . . . . Readable
_____Highlighting facilitates task	Poorly . . . . . Very well
_____Reverse video is	Inappropriate . . . . . Appropriate
_____Displays	Cluttered . . . . . Uncluttered
_____Sequence of displays	Confusing . . . . . Clear
_____Next screen in a sequence	Unpredictable . . . . . Predictable
_____Maintain a sense of position	Impossible . . . . . Easy
_____Response time for most operations	Too slow . . . . . Quickly
_____Overall reactions	Terrible . . . . . Wonderful
_____Overall reactions	Dull . . . . . Stimulating
_____Overall reactions	Difficult . . . . . Easy
_____Overall reactions	Inadequate power . . . Adequate

Table 3

One participant used '8' to indicate the highest rank in the 1-7 scale. The '8's were converted to 7's and retained in the analysis. Two participants merely circled the adjectives and these results were eliminated from calculations. There were 18 participants who did not answer every question, therefore, factor analysis excluded these 18 surveys.

The results for two questions (#26 and #27) were reversed. The adjectives for these two questions were listed in a positive - negative manner while all other questions had the adjectives listed in a negative - positive manner.

Satisfaction with the system was determined by combining four questions that asked overall reaction to the system:

36. Overall reactions....Terrible..Wonderful

37. Overall reactions....Dull...Stimulating

38. Overall reactions....Difficult...Easy

39. Overall reactions....Inadequate power...Adequate power.

The overall rating for each system was calculated by summing the responses for these questions and placing the sum into a new variable labeled 'SATISFY'.

One-way Analysis of Variance, a method for testing the null hypothesis that the population means are equal, was used to determine if there was a significant difference in the satisfaction ratings of the systems. The ANOVA was followed by the Tukey procedure, a multiple comparison procedure "used to identify which pairs of means differ following a significant F ratio in the ANOVA" (Hinkle, Wiersma, Jurs, p 368). This was used to determine which satisfaction ratings significantly differed. A Stepwise regression procedure was used to predict the contribution of each factor with the variable of system satisfaction. Stepwise regression determined which variables, individually and in combination, best predicted satisfaction. The order in which the variables were added was determined on statistical grounds. The statistical program determined the order in which the variables entered the prediction equation by first using the independent variable that has the highest correlation with the dependent variably. Factor Analysis using the Varimax Rotation was performed to locate the best way to view these factors. "Factor analysis allows a researcher to create a few variables (called factors) that do a good job of representing a lot of variables. It is therefore used to make things simpler" (Jaegar, 1990, p 320). Most factor analytic methods produce results that are difficult to interpret. "It is the configurations of tests or variables in factor space that are of fundamental

concern. In order to discover these configurations adequately, the arbitrary reference axes must be rotated. In other words, we assume that there are unique and 'best' positions for the axes, 'best' ways to view the variables in n-dimensional space" (Kerlinger, p 579). This study thus presents an ordering of the system features that designers must attend in order to achieve effective user interfaces.

Results

The variable means by school were calculated for each question plus for the new variable SATISFY. A One-Way Analysis of Variance was computed with the variable SATISFY as the dependent variable. The systems represented the independent variable with the schools used in the survey as the five levels. The Summary Table is shown in Table 4.

Summary Table
Analysis of Variance Procedure

Dependent variable: SATISFY

Source	df	Sum of Squares	Mean Square	F
Model	4	2429.3234	607.3308	16.89*
Error	104	3739.4839	35.9566	
Cor. Total	108	6168.8073		

$F_{cv} = 32.844$
* $p < .0001$

Table 4

The null hypothesis was that there was no significant difference in the satisfaction ranking of the systems. The F-ratio (16.89) summarized the variation among the 5 models compared to the variation among individual observations within the models. This F-statistic (16.89) was compared to tabulated critical values that corresponded to the .0001 alpha level. The null hypothesis that the

satisfaction rankings were equal was rejected in favor of the alternative hypothesis that there was a significant difference among the satisfaction rankings of the systems. The probability that this difference occurred by chance is .0001. Chart 1 shows the representative means for the satisfaction for each school.

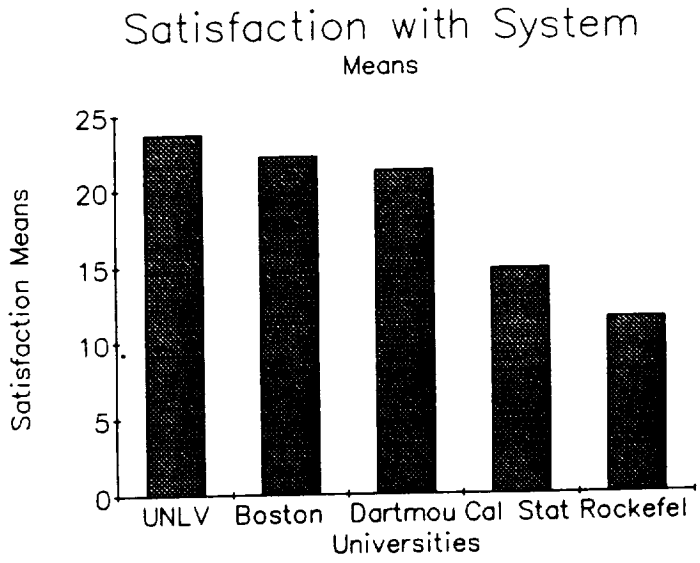


Chart 1

To find if the difference in satisfaction was significant between schools, a Tukey pairwise procedure was computed. The results showed that there was significant difference at the .05 level between all 3 schools in the top group with each of the 2 lower schools. The difference between the 3 top schools was not significant at the .05 level. Difference between the 2 lower schools was not significant at the .05 level. Thus UNLV, Boston University, and Dartmouth did not differ significantly from each other with the satisfaction of the system but did differ significantly from Cal State-Melvyl and Rockefeller University. Cal State-Melvyl and Rockefeller University systems did not differ significantly from each other in the satisfaction rate. The results are shown in Table 5:

Tukey's Studentized Range (HSD) Test for Variable Satisfy

This test controls the Type 1 experimentwise error rate
Critical Value of Studentized Range = 3.926
Comparisons significant at the .05 level are indicated by ***

Schools	Upper Limit	Mean Difference	Upper Limit
UNLV, BU	-3.863	1.484	6.831
UNLV, Dar	-2.911	2.437	7.784
UNLV, Cal	5.810	8.915	14.019***
UNLV, Rock	7.005	12.244	17.483***
BU, UNVL	-6.831	-1.484	5.563
BU, Dar	-4.185	0.952	6.090
BU, Cal	2.546	7.430	12.515***
BU, Rock	5.735	10.760	15.784***
Dar, UNLV	-7.784	-2.437	2.911
Dar, BU	-6.090	-0.952	4.165
Dar, Cal	1.394	6.478	11.362***
Dar, Rock	4.783	7.807	14.832***
Cal, UNLV	-14.019	-8.915	-3.810***
Cal, BU	-12.315	-7.430	-2.546***
Cal, Dar	-11.362	-6.478	-1.394***
Cal, Rock	-1.436	5.329	8.095
Rock, UNLV	-17.485	-12.244	-7.005***
Rock, BU	-15.784	-10.760	-5.735***
Rock, Dar	-14.832	-9.807	-4.785***
Rock, Cal	-8.095	-3.329	1.436

Table 5

A Stepwise analysis determined that 10 variables could account for nearly 79% of the SATISFY variance. The probability that this occurred by chance was .0001. Questions 36 - 39 were excluded from analysis since the sum of these scores was our dependent variable. These variables are shown in Table 6:

Variables That Account for 79% of SATISFY variance (with demographics)

Variable	Partial R Square		
Q 34	48.80		
Q 4	13.80		
Q 13	5.05		
Q 6	2.34		
Gender	1.87		
Q 12	2.26		
Q 29	1.63		
Q 7	.87		
Q 19	.64		
Q 17	.65		
Q 34	Maintain a sense of position		Impossible...Easy
Q 4	Instructions describing task		Confusing....Clear
Q 13	Terms on the screen are		Ambiguous.Precise
Q 6	Instructions for correcting errors		Confusing....Clear
Gender			Male.....Female
Q 12	Terminology relates to task domain		Distantly...Closely
Q 29	Highlighting facilitates task		Poorly...Very Well
Q 7	Instructions for getting more help		Confusing....Clear
Q 19	Contents of online help		Confusing....Clear
Q 17	Accessing online help		Complex.....Simple

Table 6

Redundancies existed due to the large number of items included on the survey. Therefore, the principal components method of factor analysis was used to reduce the number of components. A correlation matrix was computed from the responses resulting in 10 factors. The correlation of the first group of questions with SATISFY was 86%. The Varimax method was used to rotate the factors so that the variance of the squared factor loadings for a given factor was made large. Eight factors were identified through the analysis of the rotated factor pattern. They are shown in Tables 7:

Factor 1: Instructions

Q 5	Instructions for commands/choices Satisfy (the sum of questions 36-39)	Confusing....Clear
Q 4	Instructions describing task	Confusing....Clear
Q 13	Terms on the screen are	Ambiguous..Precise
Q 12	Terminology relates to task domain	Distantly..Closely
Q 8	Instructions are consistent	Never.....Always
Q 6	Instructions for correcting errors	Confusing....Clear
Q 11	Amount of feedback is user controlled	Never.....Always
Q 9	Informative feedback is appropriate	Never.....Always
Q 32	Sequence of displays	Confusing....Clear
Q 15	Meaningful prompts	Not provided..Provided
Q 34	Maintain a sense of position	Impossible....Easy
Q 10	Amount of feedback	Too Little....Too Much

Table 7a

Factor 2: Error

Q 22	Error message indicates actions to be taken	Never.....Always
Q 20	Error messages are helpful	Never.....Always
Q 21	Error message clarifies problem	Never.....Always
Q 23	Error messages are specific	Never.....Always
Q 24	Error messages are	Nasty.....Pleasing
Q 25	Error correction is	Confusing...Clear
Q 14	Abbreviations are	Confusing...Clear
Q 29	Highlighting facilitates task	Poorly....Very Well

Table 7b

Factor 3: Help

Q 18	Organization of online help	Confusing...Simple
Q 19	Contents of online help	Confusing...Clear
Q 17	Accessing online help	Complex...Simple
Q 16	Online help	Confusing...Simple
Q 1	Use by different levels of experience	Not Accomodated...Acc.
Q 7	Instructions for getting more help	Confusing...Clear
Q 2	User can tailor the interface	Difficult...Convenient
Q 3	Human memory limitations	Overwhelm..Respect

Table 7c

Factor 4: Display

Q 28	Characters in the display are	Unreadable...Readable
Q 35	Response time for most operations	Too slow...Quickly
Q 33	Next screen in a sequence	Unpredict..Predictable
Q 31	Displays	Cluttered.Unclutter
Q 30	Reverse video is	Inappropriate..Appr

Table 7d

Factor 5:

Age
Grade

Table 7e

Factor 6:

Q 26	Correcting typos is	Easy....Hard
Q 27	Undoing operations is	Easy....Hard

Table 7f

Factor 7:

School Name

Table 7g

Factor 8:

Gender

Table 7h

We then chose to omit the demographic questions in the factor analysis since they were of minimal effect. The results of the stepwise analysis determined that 9 variables could account for nearly 76% of the SATISFY variance. The probability that this occurred by chance is .0001. Questions 36 - 39 were excluded from analysis since the sum of these scores was our dependent variable. These variables are shown in Table 8:

Variables That Account for 76% of SATISFY variance (without demographics)

Variable	Partial R Square
Q 34	48.80
Q 4	13.80
Q 13	6.05
Q 6	2.34
Q 12	1.71
Q 29	1.20
Q 7	1.03
Q 33	.98
Q 19	.95

Q 34	Maintain a sense of position	Impossible...Easy
Q 4	Instructions describing task	Confusing....Clear
Q 13	Terms on the screen are	Ambiguous.Precise
Q 6	Instructions for correcting errors	Confusing....Clear
Q 12	Terminology relates to task domain	Distantly...Closely
Q 29	Highlighting facilitates task	Poorly...Very Well
Q 7	Instructions for getting more help	Confusing....Clear
Q 33	Next screen in a sequence	Unpredictable..Predict
Q 19	Contents of online help	Confusing....Clear

Table 8

Again, factor analysis was used to reduce the number of components. A correlation matrix was computed from the responses resulting in 7 factors. The correlation of the first group of questions with SATISFY was 82%. The Varimax method was again used to rotate the factors so that the variance of the squared factor loadings for a given factor was made large. Seven factors were identified through the analysis of the rotated factor pattern. They are shown in Tables 9:

Factor 1: Instructions

Q 5	Instructions for commands/choices	Confusing.....Clear
Q 4	Instructions for describing task	Confusing....Clear
SATISFY		
Q 12	Terminology relates to task domain	Distantly...Closely
Q 6	Instructions for correcting errors	Confusing....Clear
Q 8	Instructions are consistent	Never....Always
Q 13	Terms on the screen are	Ambiguous...Precise
Q 11	Amount of feedback is user controlled	Never....Always
Q 10	Amount of feedback	Too Little...Too Much
Q 15	Meaningful prompts	Not provided..provided
Q 9	Informative feedback is appropriate	Never....Always
Q 2	User can tailor the interface	Difficult...Convient

Table 9a

Factor 2: Error

Q 22	Error message indicates actions to be taken	Never....Always
Q 20	Error messages are helpful	Never....Always
Q 23	Error messages are specific	Never....Always
Q 21	Error messages clarifies problem	Never....Always
Q 24	Error messages are	Nasty....Pleasing
Q 25	Error correction is	Confusing....Clear
Q 14	Abbreviations are	Confusing....Clear

Table 9b

Factor 3: Help

Q 17	Accessing online help	Complex....Simple
Q 7	Instructions for getting more help	Confusing....Clear
Q 19	Contents of online help	Confusing....Clear
Q 16	Online help	Confusing....Simple
Q 18	Organization of online help	Confusing....Simple

Table 9c

Factor 4: Display

Q 31	Displays	Cluttered...Unclutter
Q 33	Next screen in a sequence	Unpredictable..Pred
Q 32	Sequence of displays	Confusing....Clear
Q 34	Maintain a sense of position	Impossible....Easy
Q 28	Characters in the display are	Unreadable..Readable
Q 29	Highlighting facilitates task	Poorly....Very Well

Table 9d

Factor 5:

Q 35	Response time for most operations	Too slow...Quickly
Q 30	Reverse video is	Inappropriate..Appr

Table 9e

Factor 6:

Q 26	Correcting typos is	Easy....Hard
Q 27	Undoing operations is	Easy....Hard

Table 9f

Factor 7:

Q 1	Use by different levels of experience	Not accommod..accom
Q 3	Human memory limitations	Overwhelmed...Respect

Table 9g

Conclusion

We concluded that considering the significant difference in the satisfaction level of two groups of systems the factor analysis must be studied to provide further insight into the reasons for the difference. The factor analysis including demographic questions began to fall into distinct categories of features. When the demographic questions were eliminated, very explicit arrangements of the features were created thus allowing the main groupings of features to fall into four categories. Labels for the four categories were chosen based on the features included in each category. Factor 1 grouping consisted of instructions, terminology, feedback and prompts therefore we chose the name Instructions. The second factor grouping contained 6 out of 7 questions containing the word "error", therefore Error was naturally that factor label. Each question in the third grouping contained the word "help" and again we labeled that factor with the common word Help. The last significant grouping contained questions relating to the way appeared on screen therefore we chose Display for the factor label. We interpreted these labels as axes to be used with the multidimensional analysis procedure described in Chapter 4. These factor groups were deemed most important to the users in the use of the online catalog systems. It may be of benefit to designers of future systems to use this smaller number of dimensions when initiating their strategy.

Combining these results with the results from the multidimensional analysis, we concluded that the structure of the system was not as important as the explicit features available.

Berenson, M., Goldstein, M., & Levine, D. *Intermediate statistical methods and applications*. Englewood Cliffs: Prentice-Hall.

Hinkle, D., Wiersma, W., & Jurs, S. *Applied statistics for the behavioral sciences*. Boston: Houghton Mifflin Co.

Jaeger, R. *Statistics: A spectator sport*. Newbury Park: Sage Publications.

Kerlinger, F. *Foundations of behavioral research*. Fort Worth: Holt, Rinehart & Winston.

Detailed System Design Charts and Comparative Analysis

INTRODUCTION

Flowcharts give a graphical representation for the definition, analysis, or solution of a problem with symbols being used to represent operations. A flowchart is a visual algorithm which can be helpful in locating errors in planning. Therefore we selected a simple charting system (Inspiration 2.0 for the Macintosh) for diagramming the features within 30 library online catalogs. The flowcharts provided an efficient way to determine what steps or features had been omitted in the design of individualized library online card catalogs.

METHODOLOGY

Billy Barron, the University of North Texas VAX/UNIX Systems Manager, coordinated the selection of the online catalogs to be diagrammed. Using Hytelnet, a utility which gives an IBM-PC user instant access to all Internet-accessible library catalogs, he assigned each of us a group of five systems with each group attempting to maintain the same variety. This form of sampling is purposive sampling and is described by Kerlinger as "...form of nonprobability sampling... which is characterized by the use of judgment and a deliberate effort to obtain representative samples by including presumably typical areas or groups in the sample" (p 120). We explored the library catalogs at these addresses and diagrammed the systems displaying all major system features and sequences in depth/breadth charts. The resulting charts were models only and were not obtained from designers of the system. Assessment of the systems was influenced by the background of individual researchers and must be recognized as a potential exogenous variable. Library systems studied were treated as a problem domain solved by different designers in different ways according to the constraints of specific environments. The purpose of the charting was to enable

us to study any visual correlation between flow of the system, available features, and desirability of the system.

The thirty library catalogs explored were categorized by the specific system used. Eight of the thirty universities used the NOTIS system:

(1) Washington University at St. Louis

(2) Auburn

(3) University of Buffalo

(4) California State

(5) Indiana

(6) University of Delaware

(7) Clemson

(8) University of Minnesota.

Brigham Young University used the BLCMP/NOTIS system.

Three of the universities used the VTLS system:

(1) Virginia Tech

(2) University of North Texas

(3) New Mexico State.

The Innovative Interface system was used by:

(1) Colby

(2) University of Oregon

(3) University of Nevada at Las Vegas

GEAC was represented by:

(1) Lehigh

(2) Oberlin

(3) University of Western Ontario

BUCAT/GEAC was represented by University of Saskatchewan. Boston University used the TOMUS system and Dartmouth used the Z39.48 system. Individualized systems were used by:

(1) Monterrey

(2) Merit

(3) LaTrob

(4)Rockefeller University

(5) Library of Congress

(6) University of Texas at Austin

(7) University of Maryland.

Variations occurred within the charting of universities using the same system. Some of these variations were expected to be a result of enhancements to the introduction of the system while other variations were expected to be a result of individual interpretation of the system itself. However, generalities were perceived within the systems.

RESULTS

NOTIS systems offered various choices to the user. The Online Public Access Catalog at each university however offered only Author, Title, Subject, Keyword and Call Number as choices at the opening search menu. The University of Minnesota (Chart 1) and Clemson University (Chart 2) both offered searches by author, title, subject, keyword and call number along with university-specific information. Varied options were available at Washington at St. Louis (Chart 3) however, the catalog information segment included searched by author, title, and subject. As the user moved deeper into the system, the diagramming became more confusing and less procedural exhibiting numerous "Go To" options.

Chart 1

Chart 2

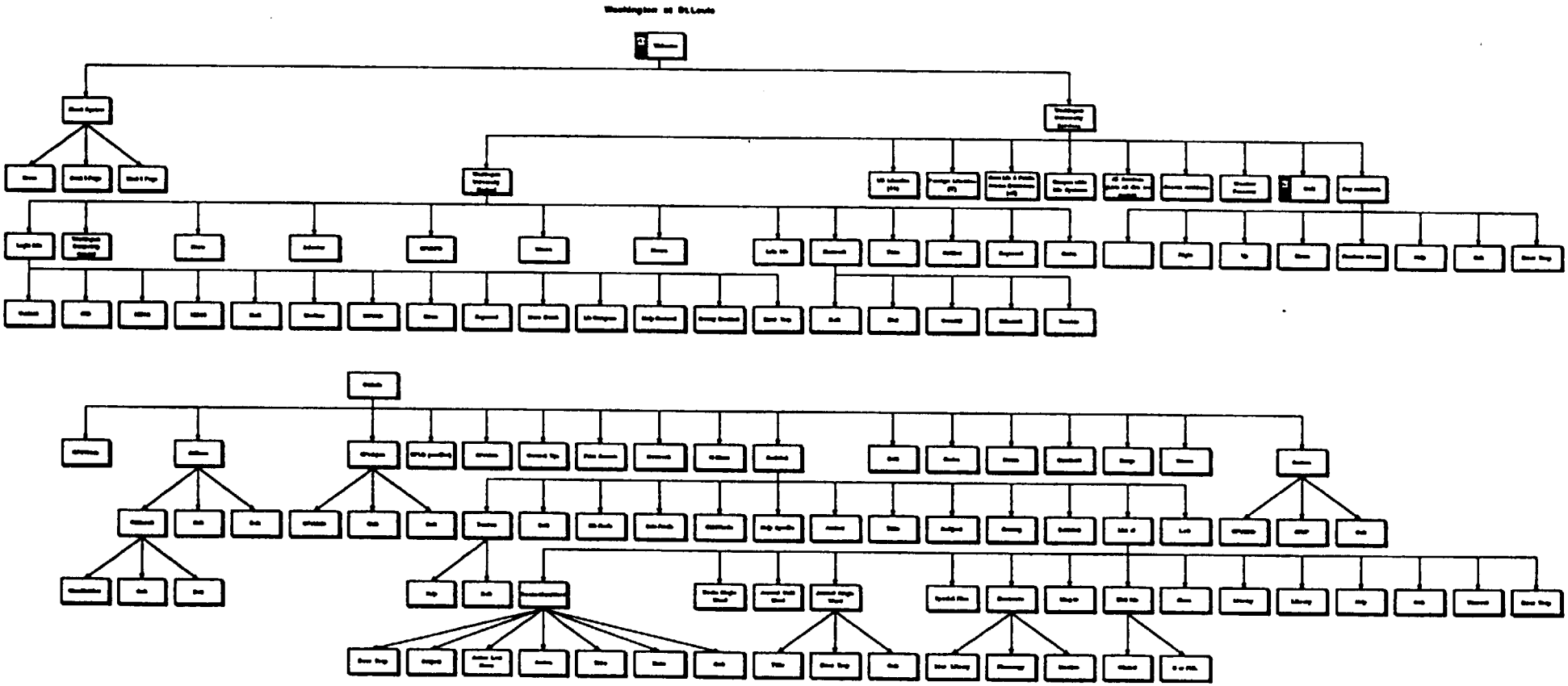


Chart 3a

Washington at St.Louis 1

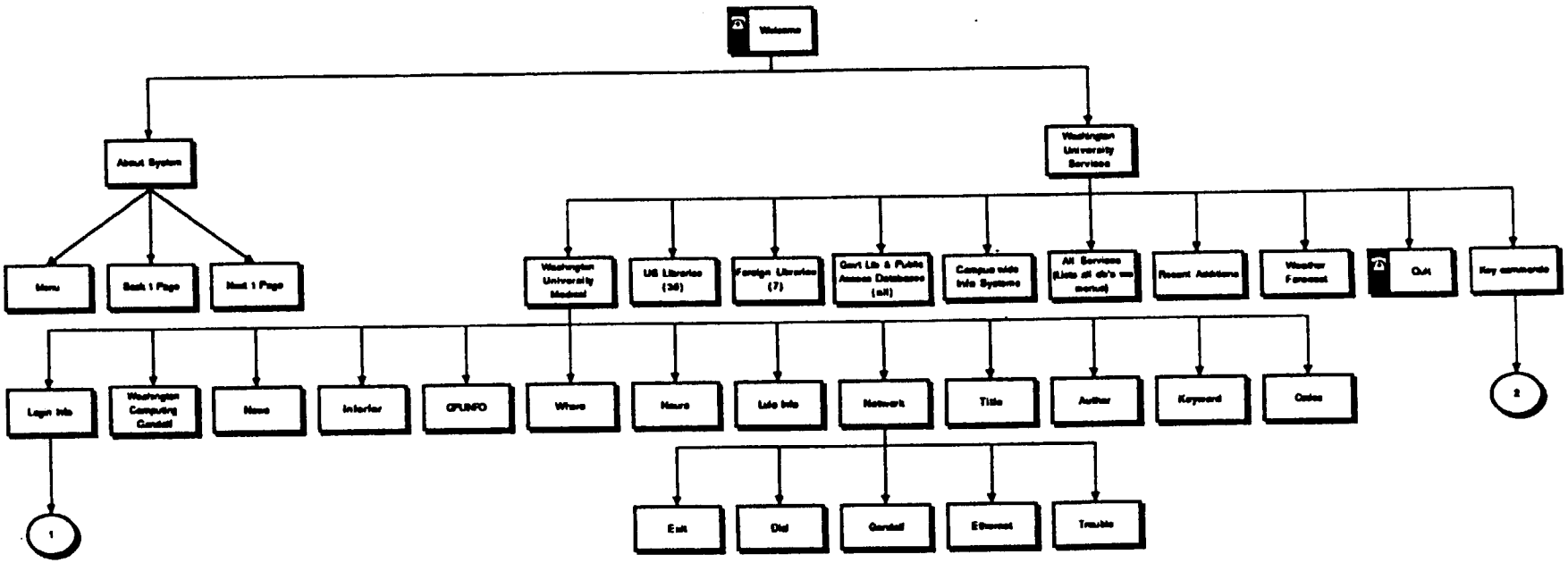


Chart 3b

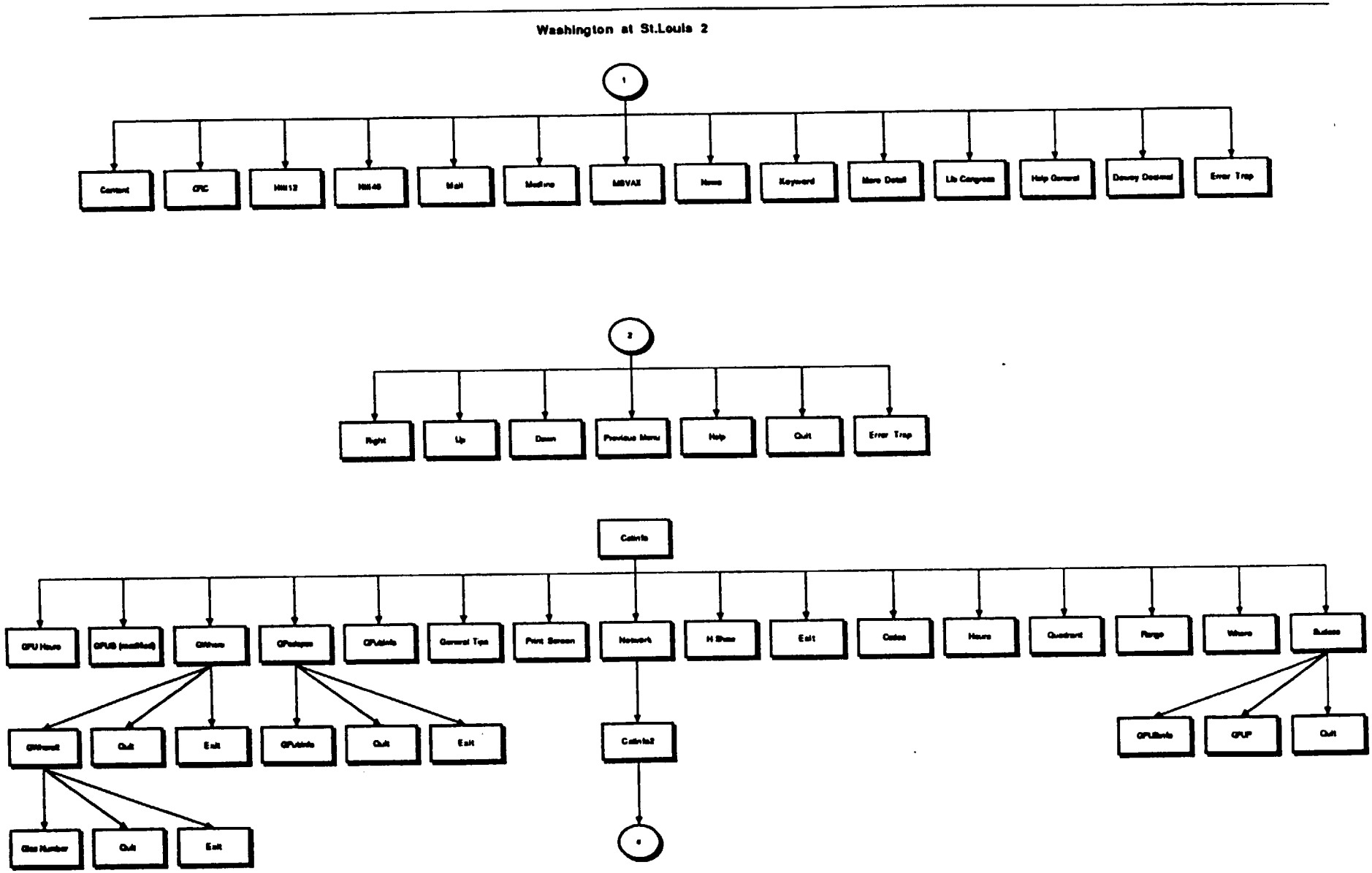

Washington at St.Louis 2
1
Current
CPC
HW12
HW48
Mail
Medline
MBVAX
News
Keyword
More Detail
Lib Congress
Help General
Dewey Decimal
Error Trap
2
Right
Up
Down
Previous Menu
Help
Quit
Error Trap
Calmlb
GPU Hours
GPUB (modified)
GWhere
GPUdepot
GPUdmlb
General Tips
Print Screen
Network
H Show
Exit
Codes
Hours
Quadrant
Range
Where
Subsite
GWhereE
Quit
Exit
GPUdmlb
Quit
Exit
Calmlb2
GPUBmlb
GPUP
Quit
Gbs Number
Quit
Exit
4

Chart 3c

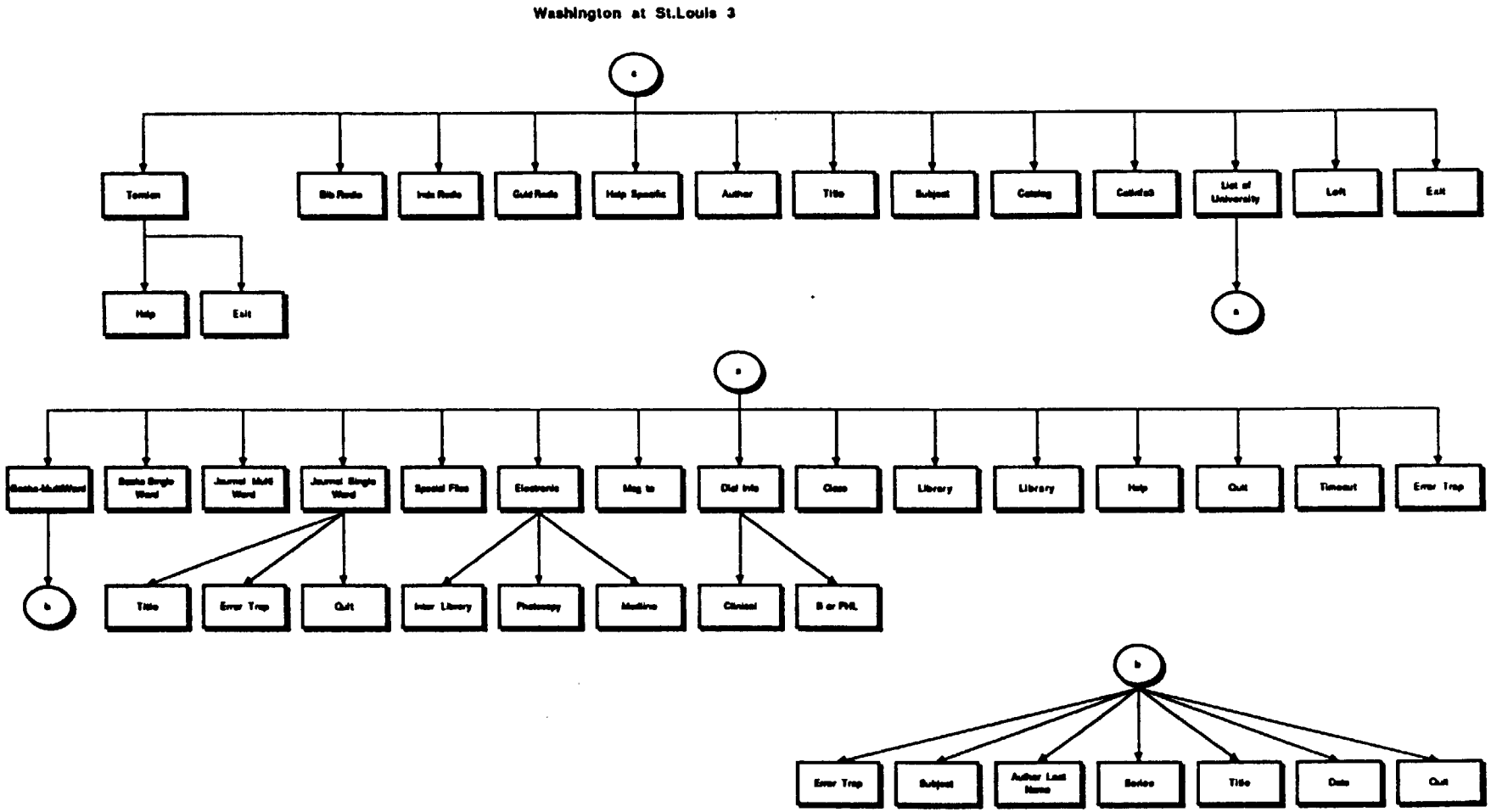

Washington at St.Louis 3
Help
Exit
Help
Quit
Error Trap
Subject
Author Last Name
Series
Title
Date
Quit

Chart 3d

Chart 5

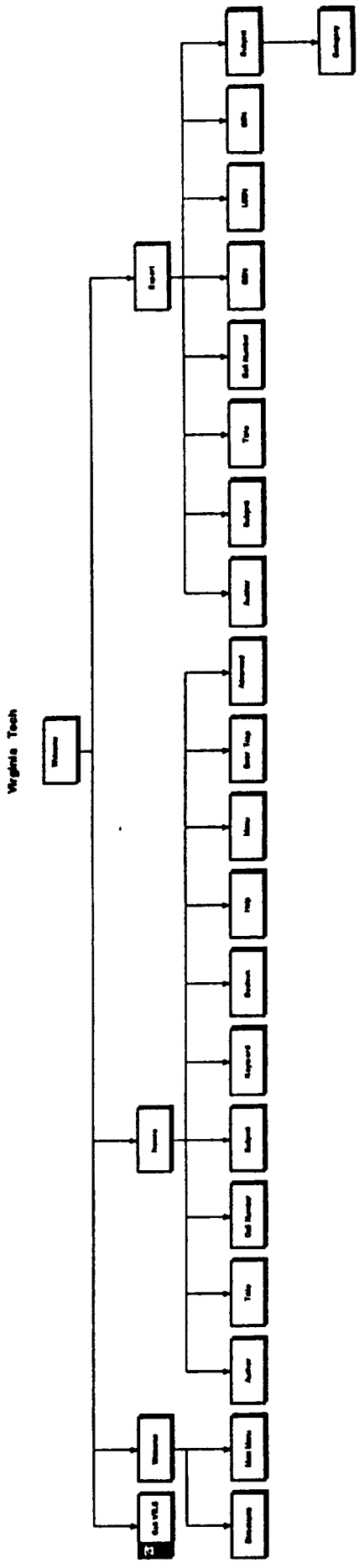


Chart 6a

Chart 4-5

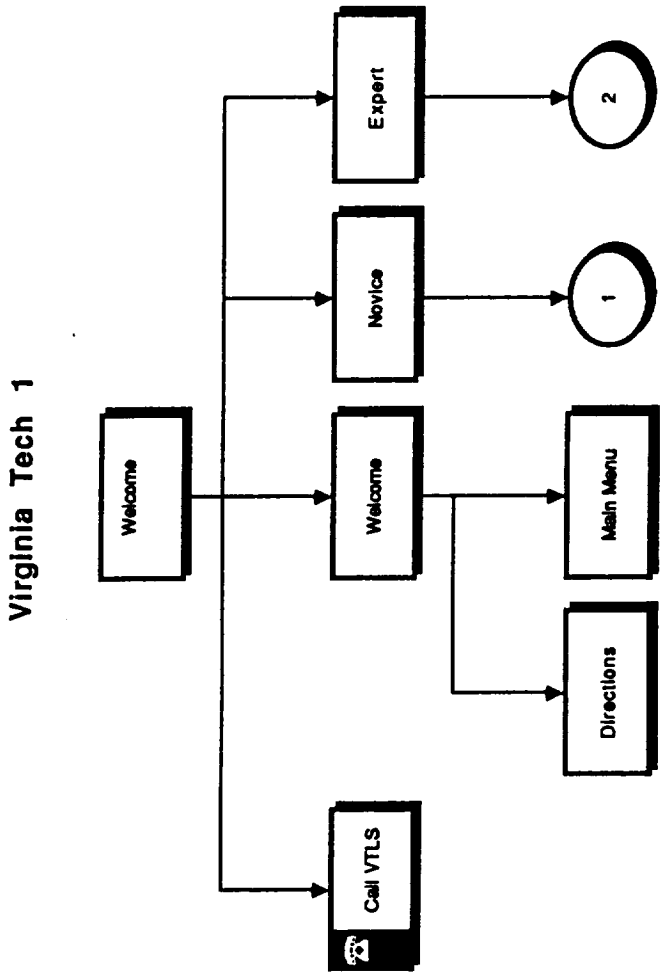
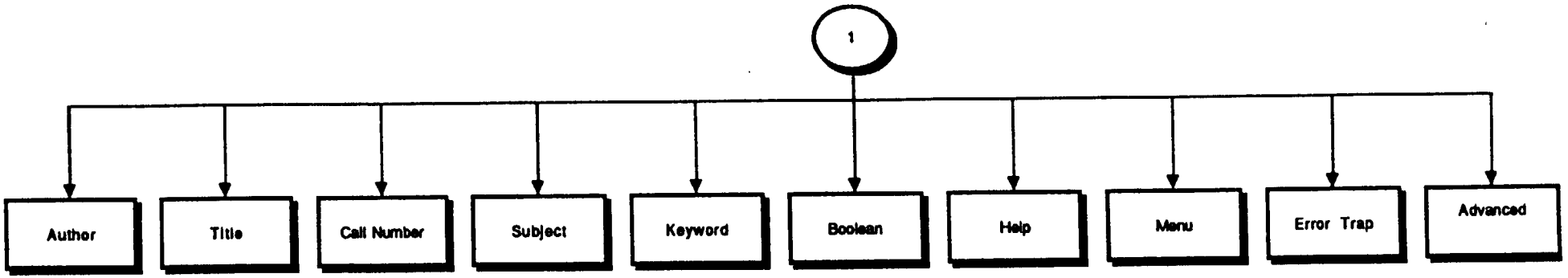


Chart 6b

Virginia Tech 2



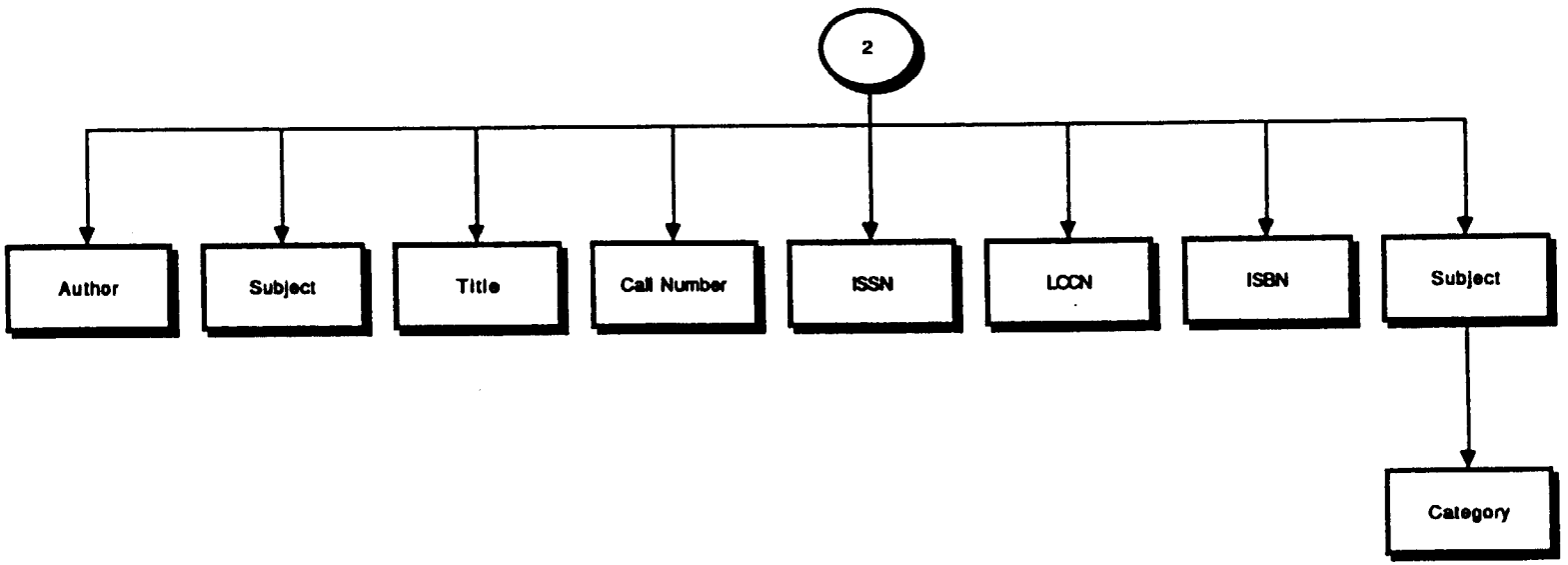


Chart 6c

VTLS systems resulted in simple, concise charting. The charts lacked depth and breadth indicating that the options offered were limited. Author, Title, Call Number, and Subject searches were offered at each VTLS system's opening search menu as shown by the chart from New Mexico State University (Chart 4). Some added Keyword and Boolean to the opening menu as exhibited by the chart from the University of North Texas (Chart 5). These NOTIS systems worked down to a 5th or 6th level and returned the user to the introductory screen. Virginia Tech offered the novice a different menu where the user was continually prompted (Chart 6).

Innovative Interface systems resulted in intricate mapping with very detailed menus. As indicated by the chart from the University of Oregon (Chart 7), many options not available on other systems were found here such as browsing, limiting searches, searching on nearby shelves, and searching items with the same subject. The charts showed substantial depth.

GEAC systems had various levels of help both for the new user and the advanced user. The help levels appeared as extensive as the catalog itself as shown in the chart from Oberlin (Chart 8). The system was command driven therefore some researchers chose to map the system (Oberlin, Chart 8) for both the display (giving instructions for moving within the system) and the searching. The BUCAT/GEAC system map matched the other GEAC systems in the above description.

The TOMUS system as displayed by Boston University (Chart 9) resulted in a simple map that was limited in breadth and depth indicating that the system was not powerful. There were three options at the opening screen: Browse, Find, and Select File. The Find option contained the Title, Author and Search options including display functions and limiting functions in a deeper level.

Chart 4

Chart 7

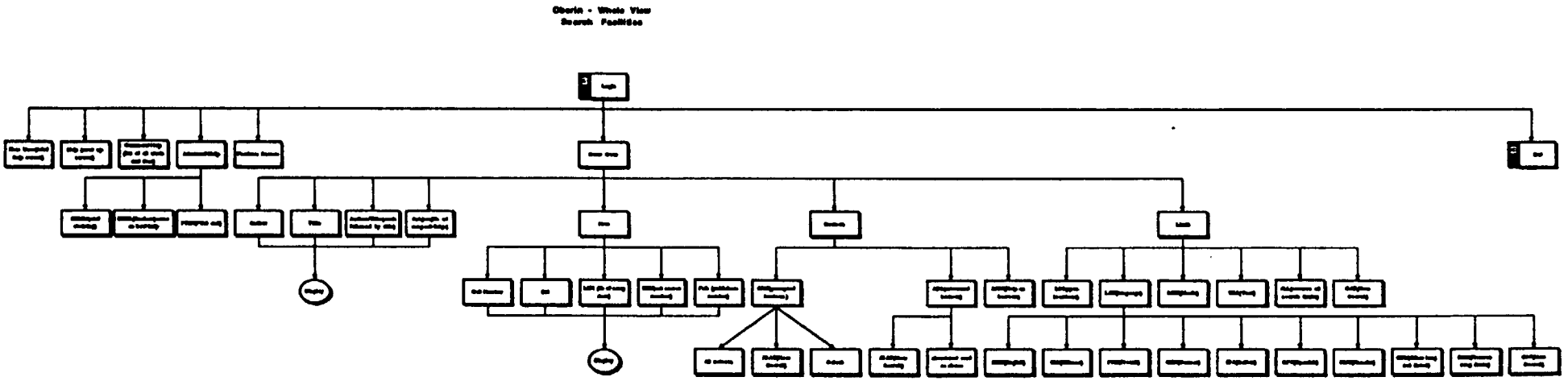


Chart 8a

Oberlin 1
Search Facilities

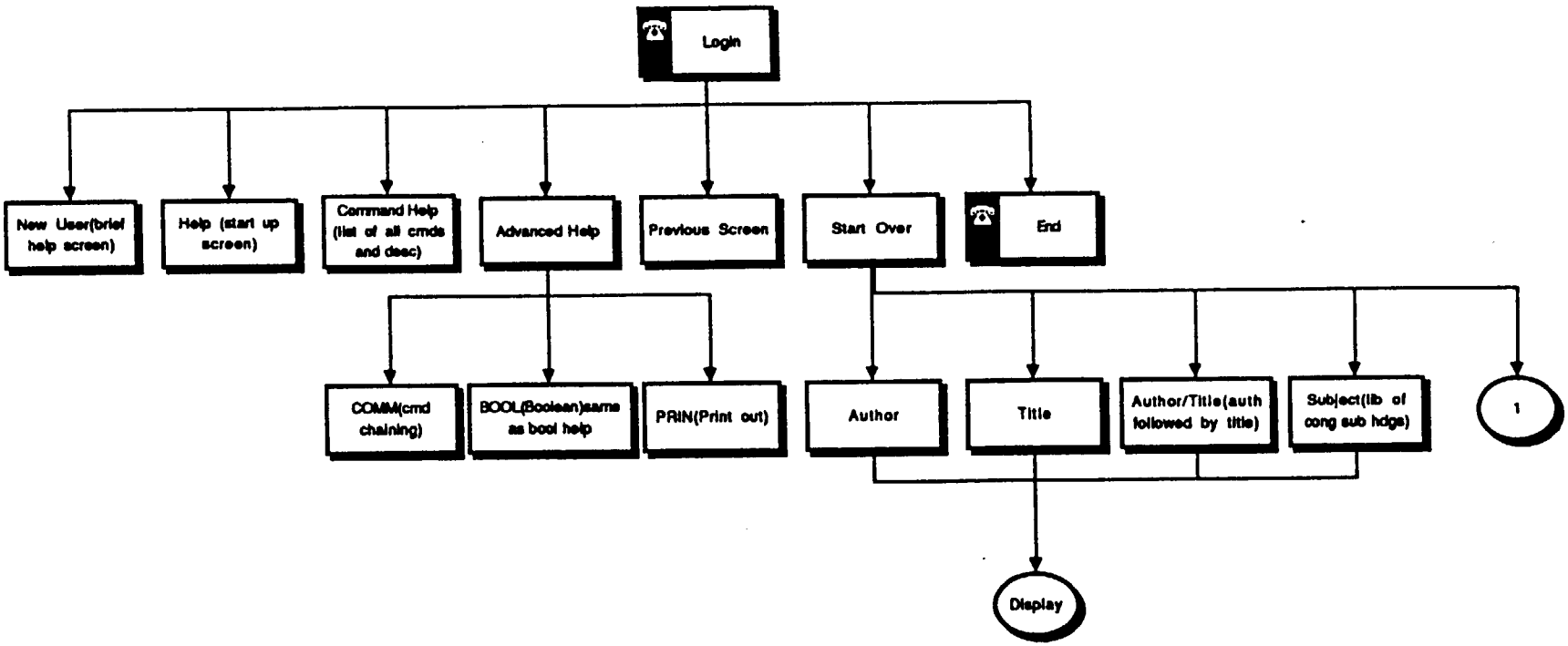


Chart 8b

Oberlin 2
Search Facilities

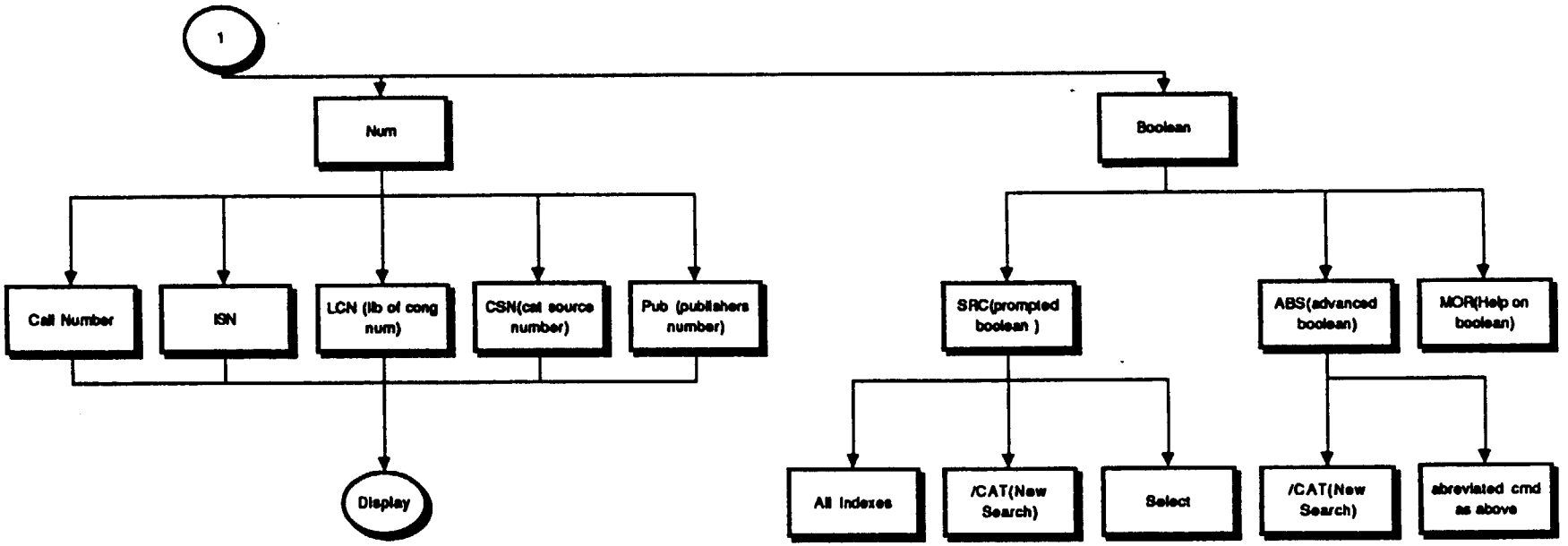
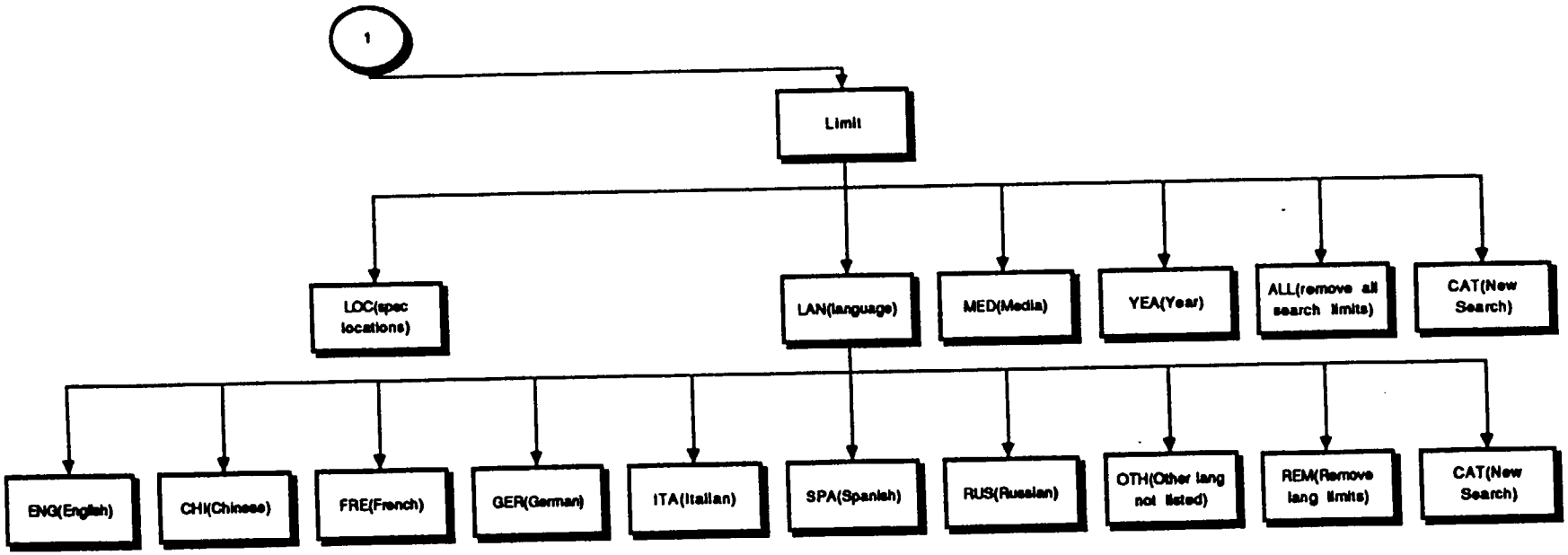


Chart 8c

Oberlin 3
Search Facilities



Oberlin 4
Display Facilities

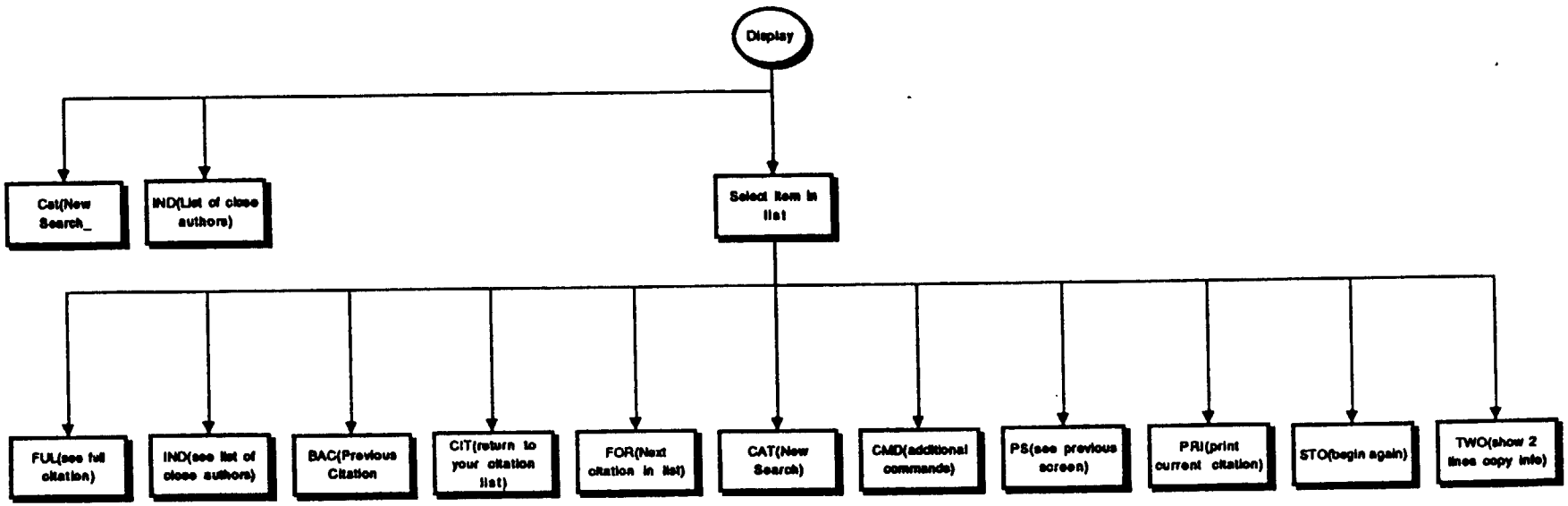


Chart 8e

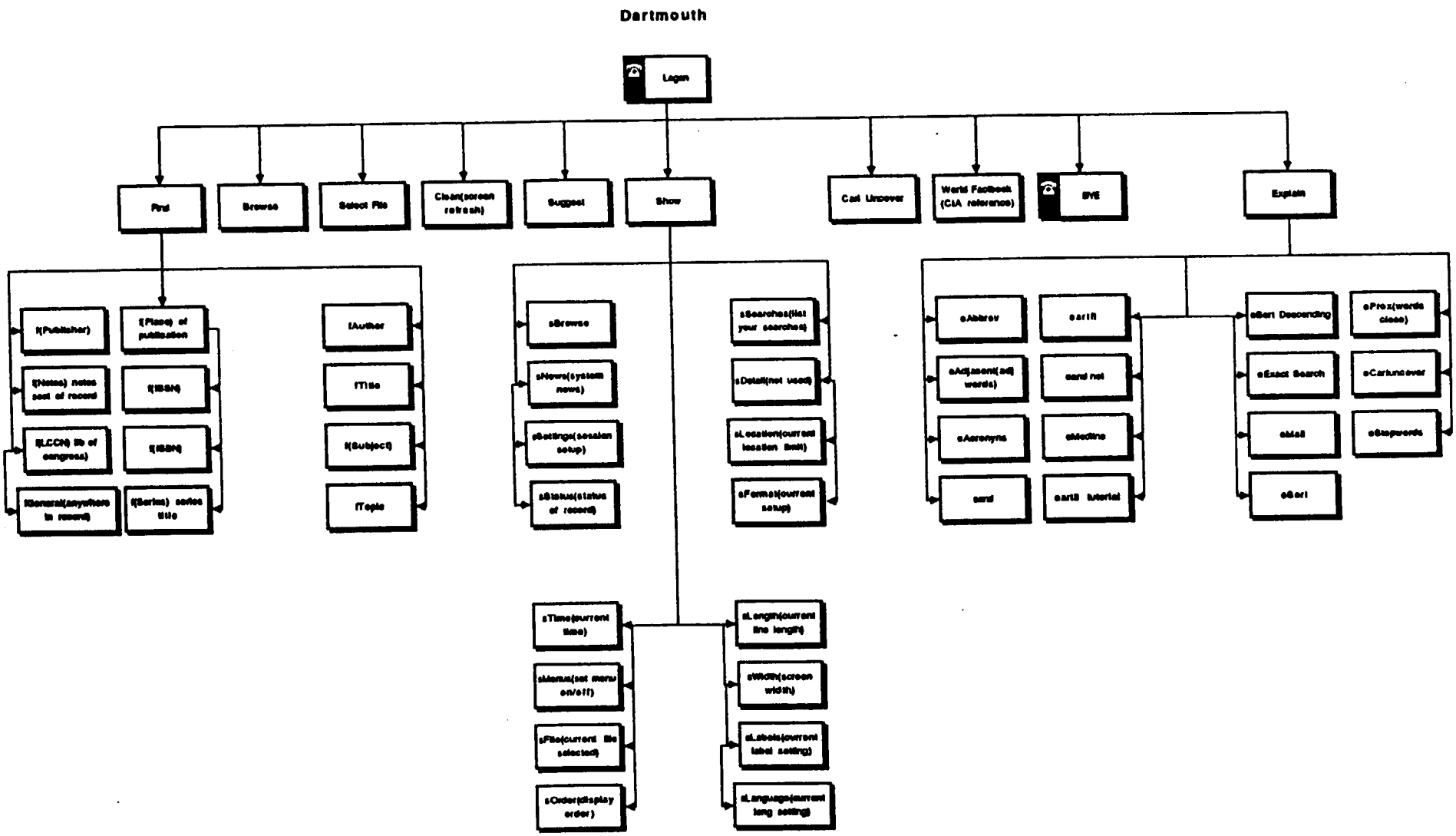

Dartmouth
Logon
Find
Browse
Select File
Clean(screen refresh)
Suggest
Show
Cat Unicover
World FactBook (CIA reference)
BYE
Explain
f(Publisher)
f(Place) of publication
f(Notes) notes part of record
f(ISSN)
f(LCCN) lib of congress)
f(ISBN)
f(General(anywhere in record)
f(Series) series title
fAuthor
fTitle
f(Subject)
fTopic
sBrowse
sNews(system news)
sSettings(session setup)
sStatus(status of record)
sSearches(list your searches)
sDetail(not used)
sLocation(current location limit)
sFormat(current setup)
sTime(current time)
sMenus(set menu on/off)
sFile(current file selected)
sOrder(display order)
sLength(current line length)
sWidth(screen width)
sLabels(current label setting)
sLanguage(current lang setting)
eAbbrev
eAdjacent(adj words)
eAcronyms
send
earth
send not
eMedline
earth tutorial
eSort Descending
eExact Search
eMail
eSort
eProx(words close)
eCarlUncover
eStopwords

Chart 10a

Dartmouth 1

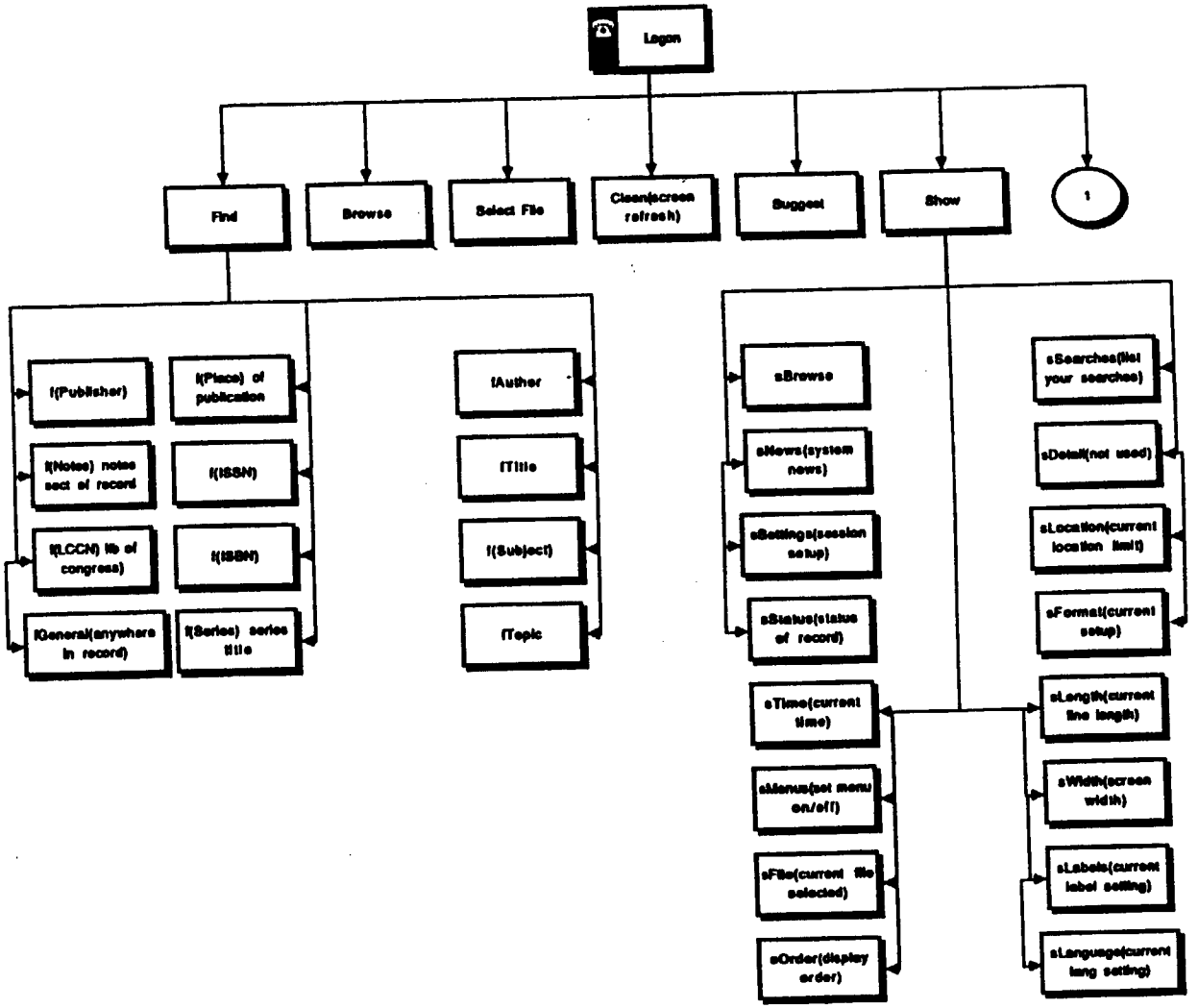


Chart 10b

DARTMOUTH 2

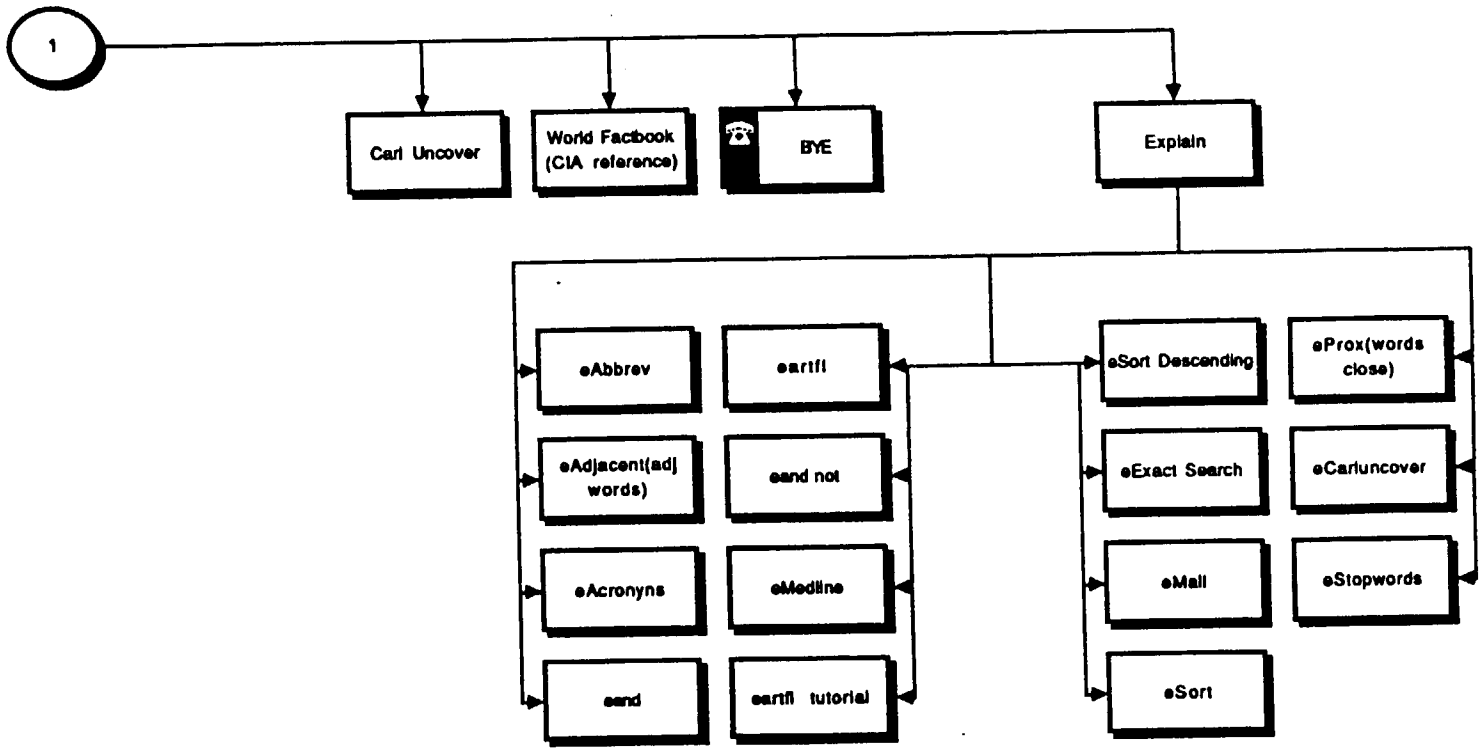


Chart 10c

Chart 11

Chart 12

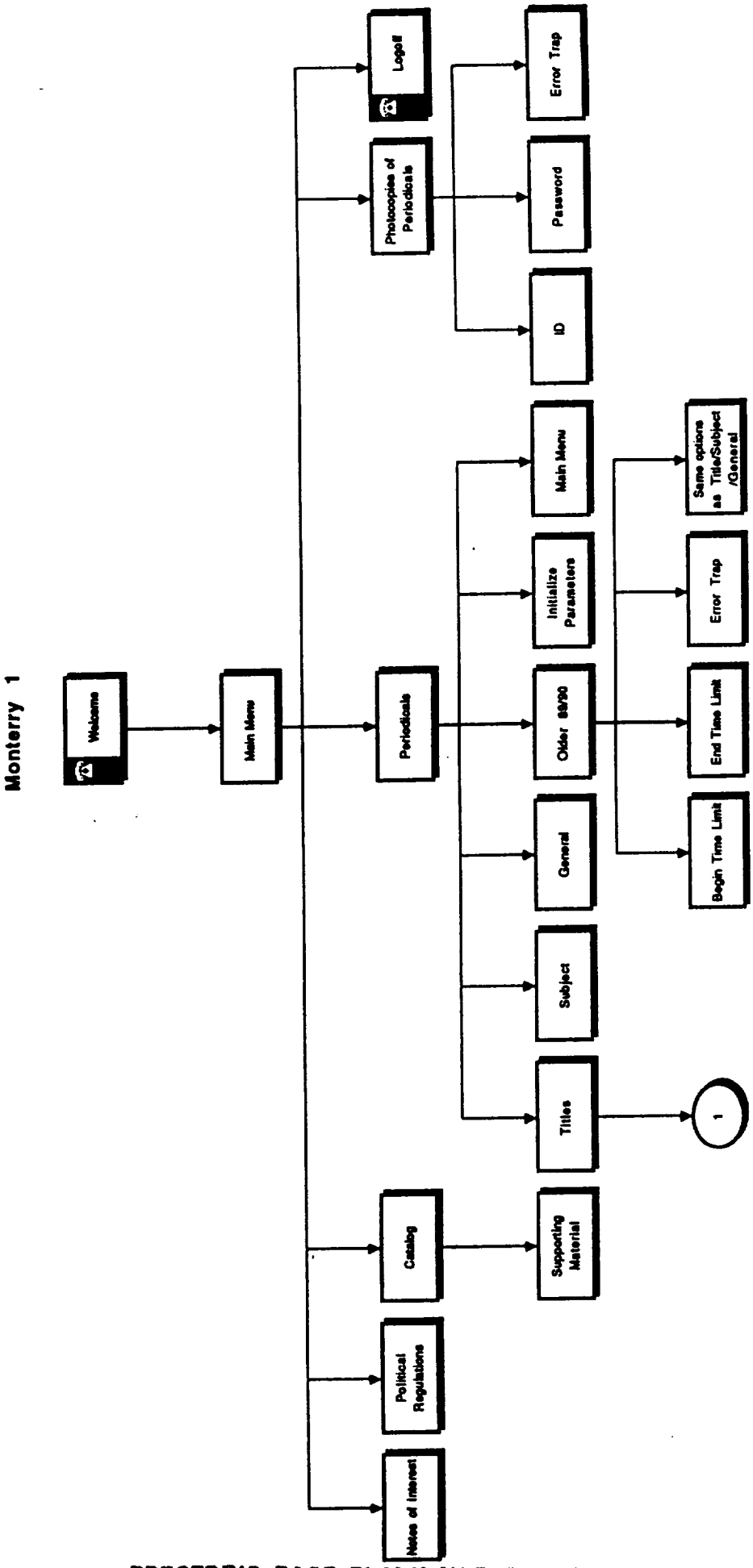


Chart 13a

Chart 11 + 12.

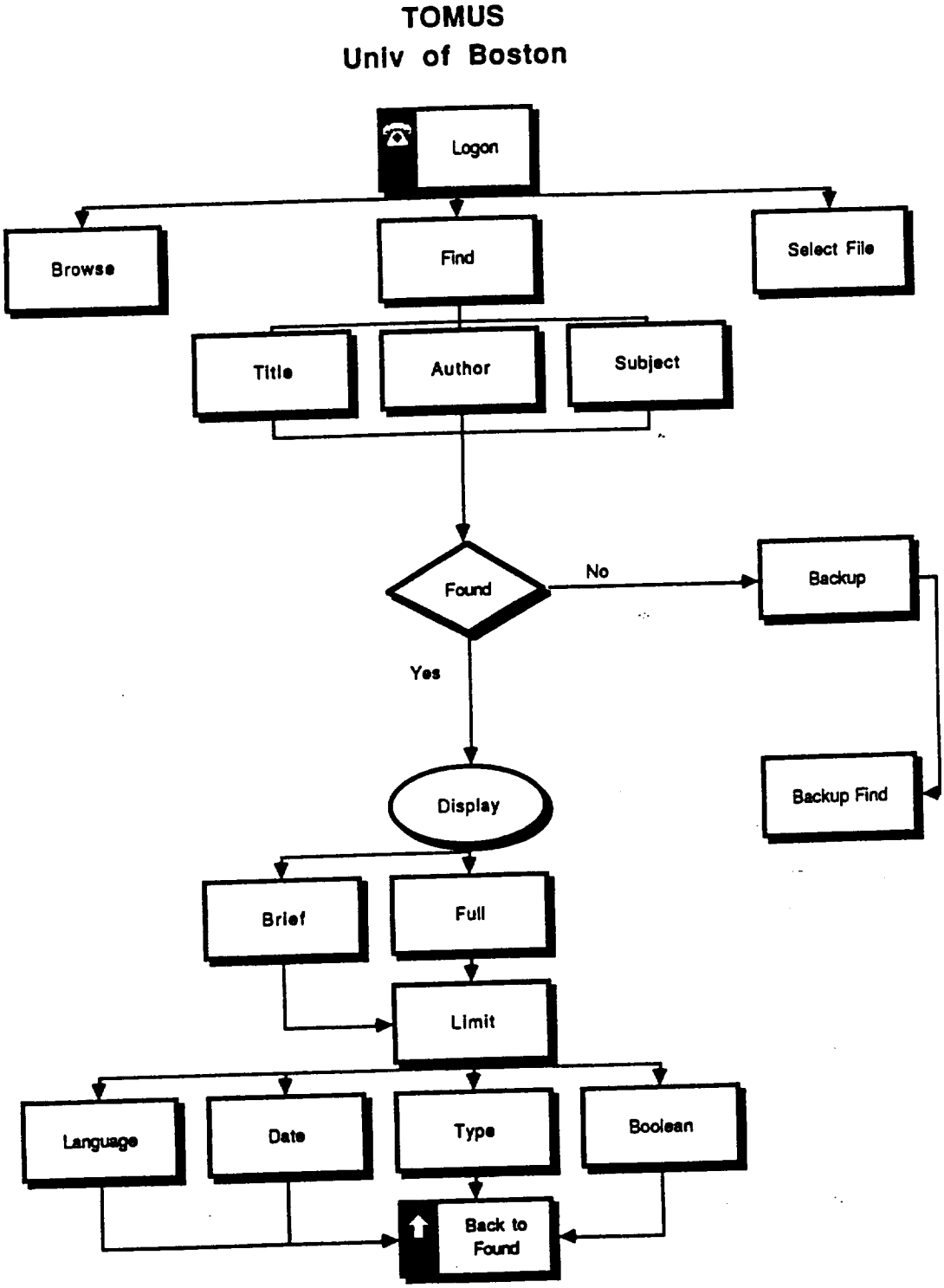

TOMUS
Univ of Boston
Logon
Browse
Find
Select File
Title
Author
Subject
Found
No
Backup
Yes
Backup Find
Display
Brief
Full
Limit
Language
Date
Type
Boolean
Back to Found

Chart 9

The Z39.58 system (as shown by Dartmouth, Chart 10a) had very few options for searching available at the first level and did not appear from the chart to flow efficiently. The search functions were limited to Find, Show, and Explain and demonstrated depth in these areas (Chart 10b). After the first level, more options became available, but still did not flow systematically in the diagram.

Miscellaneous systems were a heterogeneous group. LaTrobe (Chart 11) contained the searches by Author, Title, Subject, and included Corporate, Serials, Word Search and ISBN. Each of these functions developed into several layers with query and display levels. Help was available at three levels. The University of Texas at Austin (Chart 12) presented an extensive menu upon entry into the system. However, the card catalog was divided into the more traditional Author, Title, Keyword, Subject and Call Number search functions. Options were available here to send messages, request items, report errors, and suggest a purchase. Monterry (Chart 13) did not appear to flow systematically. The Catalog function ended with Supporting Material while Titles and Subject were functions available only through Periodicals. Warwick (Chart 14), using a BLCMP system, was limited in both breadth and depth. An option was available for Quick searches with the traditional Author, Title, Subject, and Keyword also offered at that level. The system lacked limiting functions of any type. Brigham Young University, a combination BLCMP/NOTIS system (Chart 15) offered the traditional search functions combined with help for each function. Limiting functions were available at a lower level in Keyword. The system chart appeared very flat with little depth. The Library of Congress system (Chart 16) was a broad system with search functions feeding into a query entry with display options. The University of Maryland Law Library (Chart 17) offered Name, Word and Browse functions. Title, Series and Call Number were under Browse.

Monterry 2

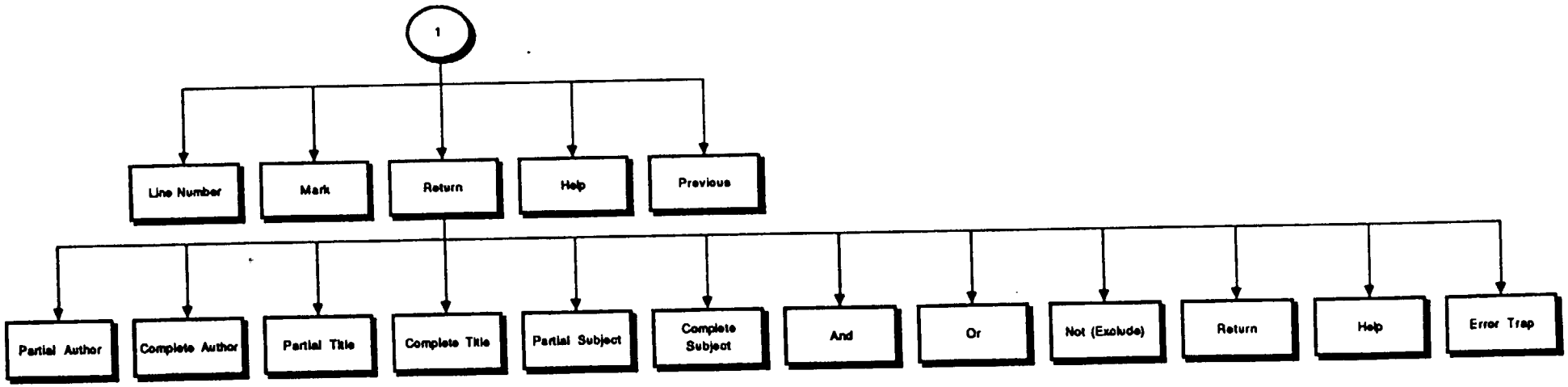


Chart 13b

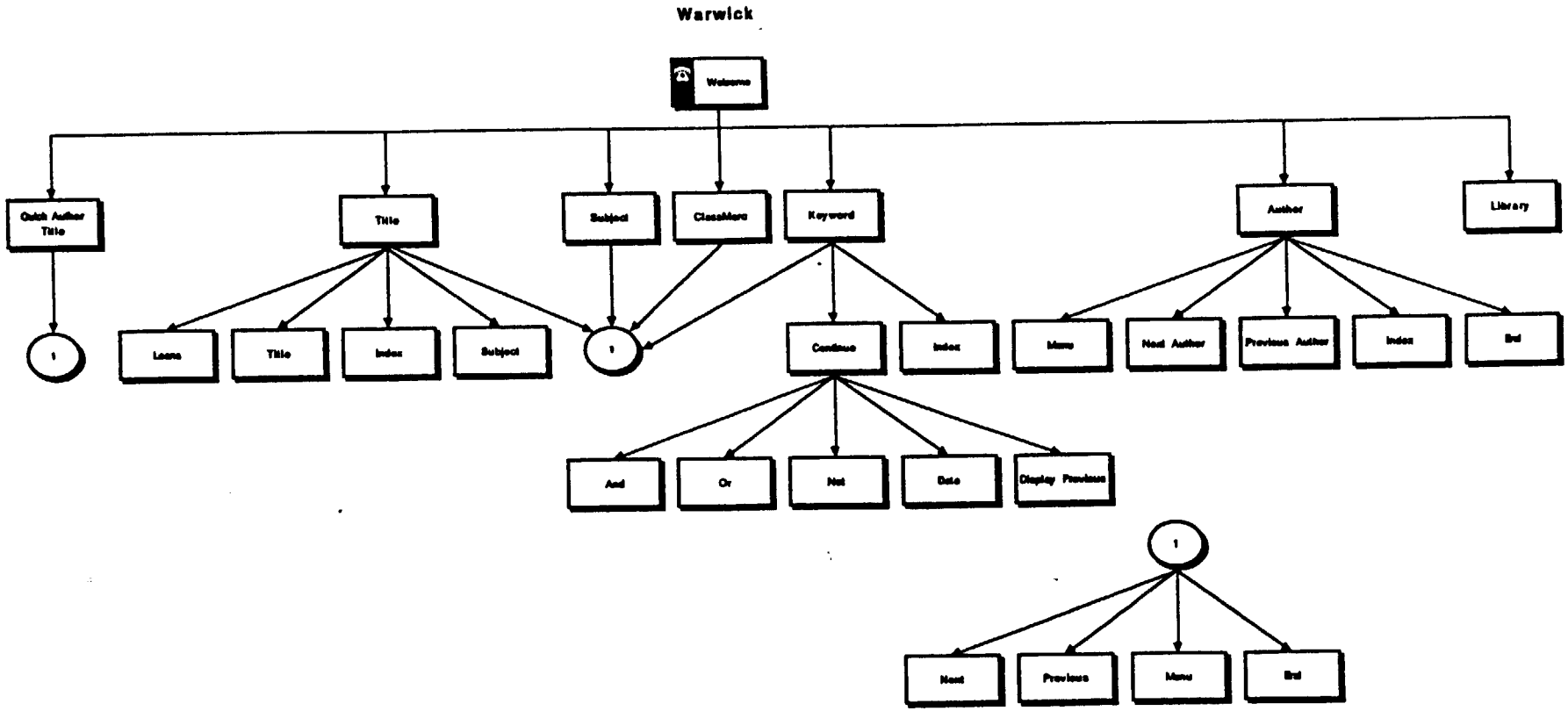

Warwick
Welcome
Quick Author Title
Title
Subject
Classified
Keyword
Author
Library
1
Loans
Title
Index
Subject
1
Continue
Index
Menu
Next Author
Previous Author
Index
End
And
Or
Not
Date
Display Previous
1
Next
Previous
Menu
End

Chart 14a

Warwick 1

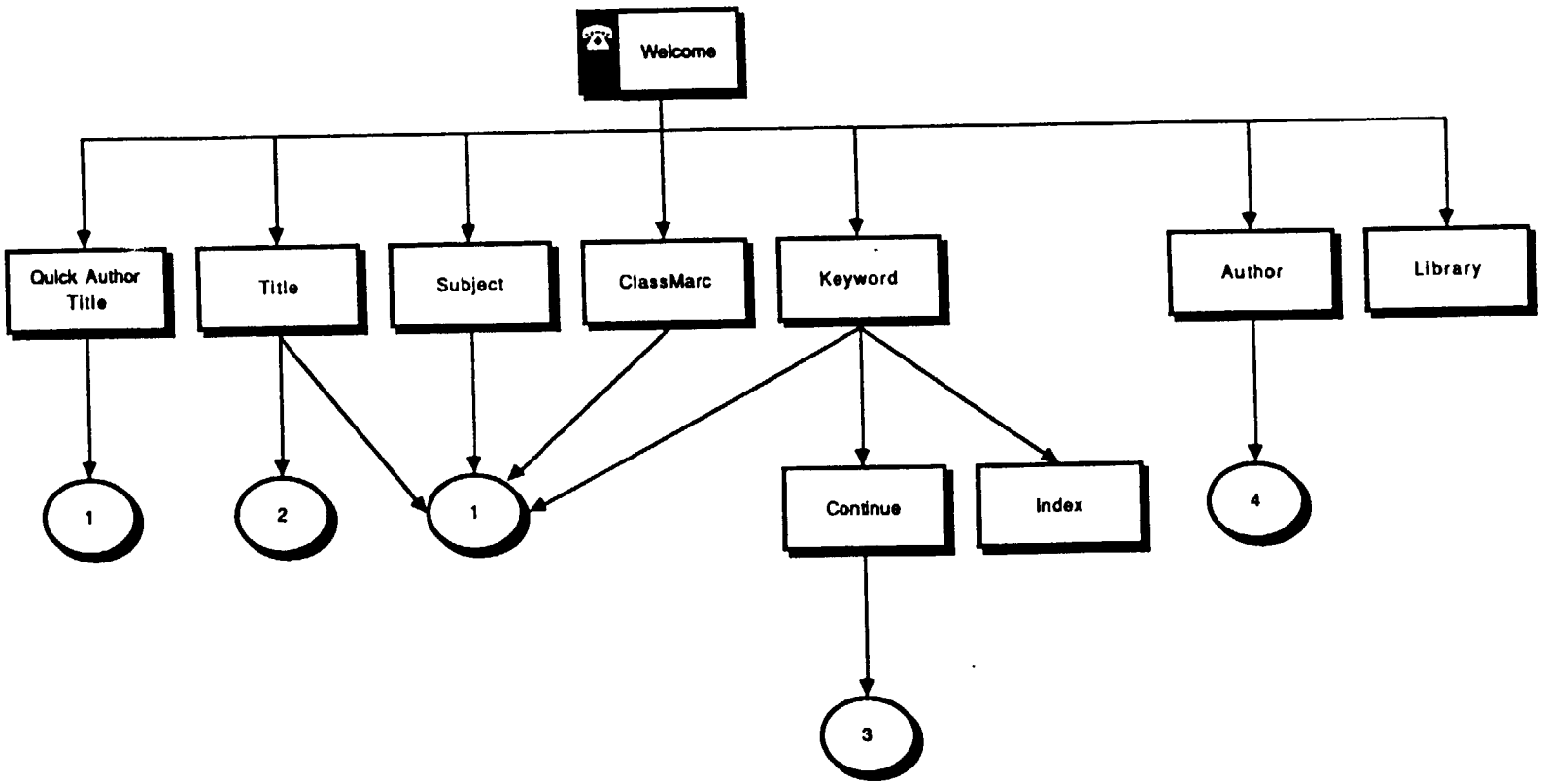


Chart 14b

Warwick 2

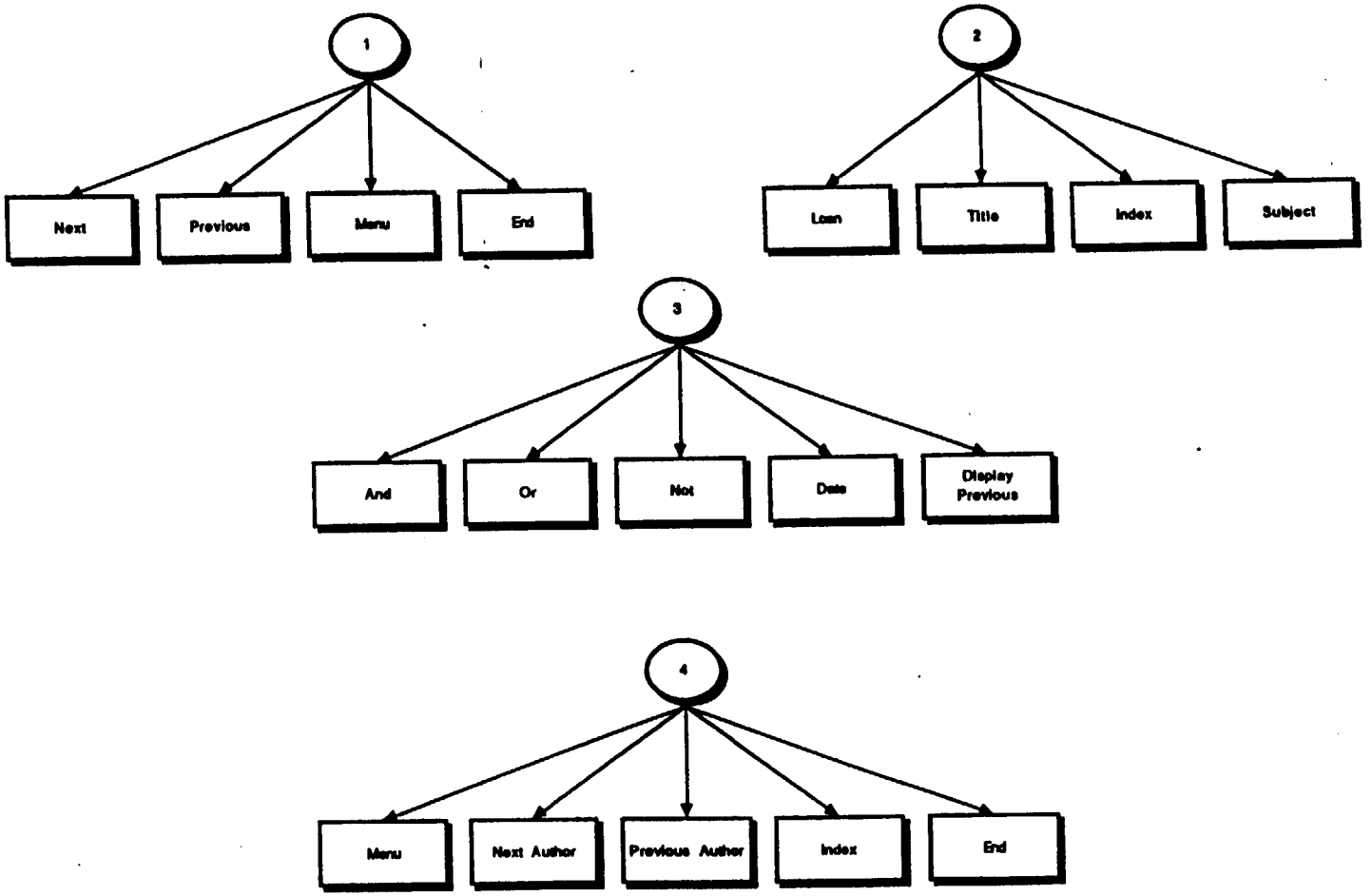


Chart 14c

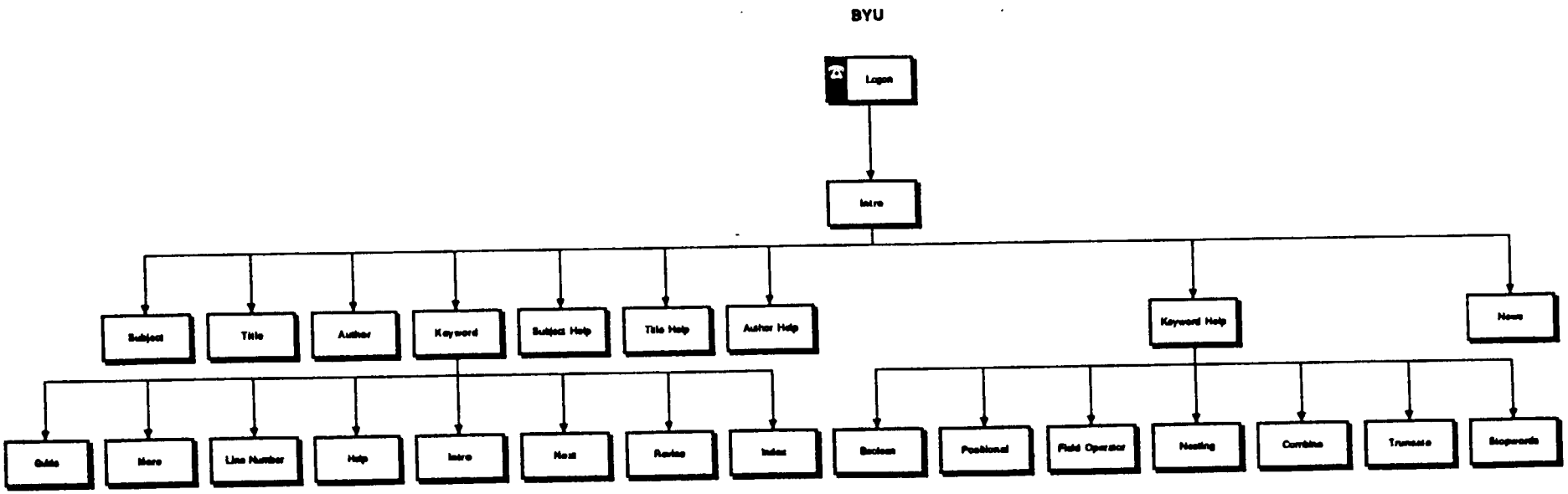

BYU
Logon
Intro
Subject
Title
Author
Keyword
Subject Help
Title Help
Author Help
Keyword Help
News
Quits
More
Line Number
Help
Intro
Next
Review
Index
Boolean
Positional
Field Operator
Nesting
Combine
Truncate
Stopwords

Chart 15a

BYU 1

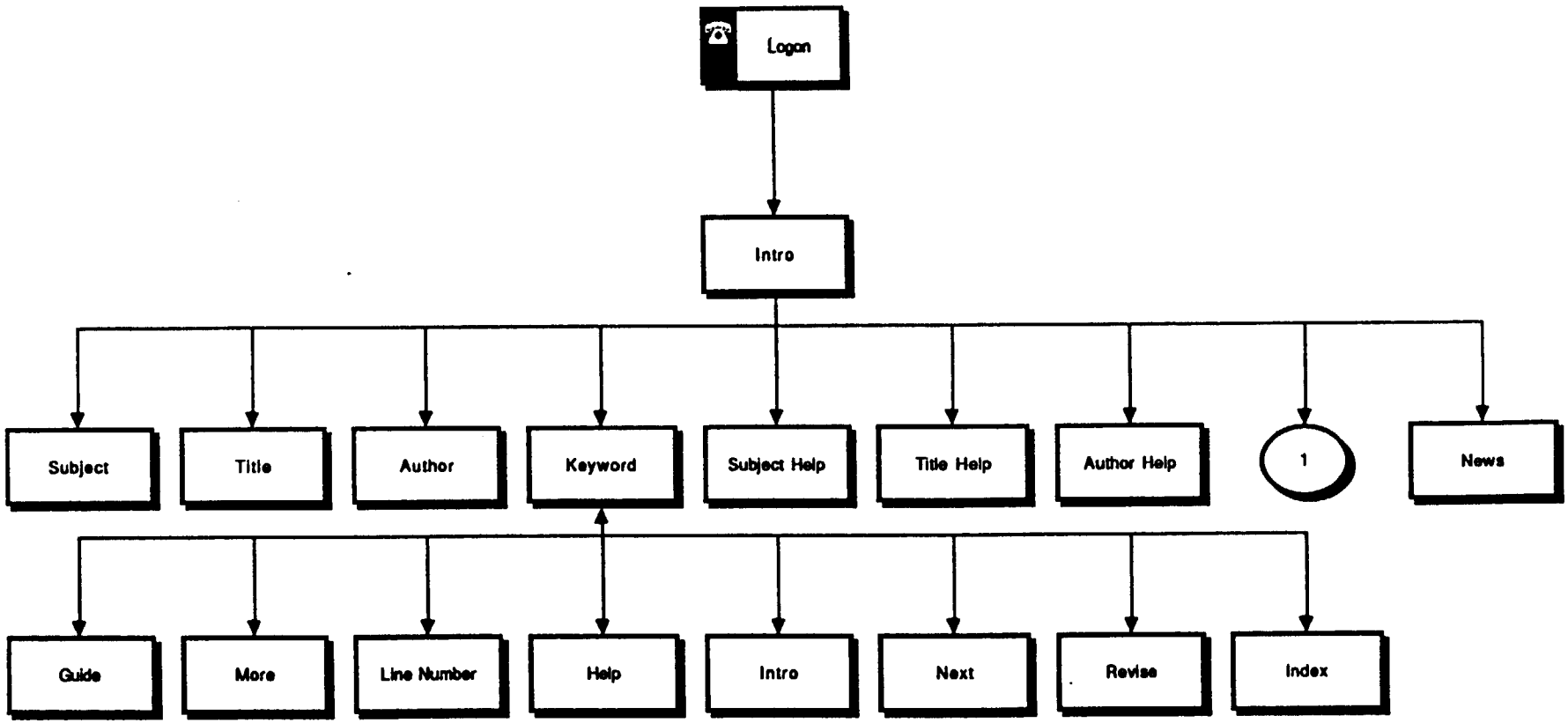


Chart 15b

BYU 2

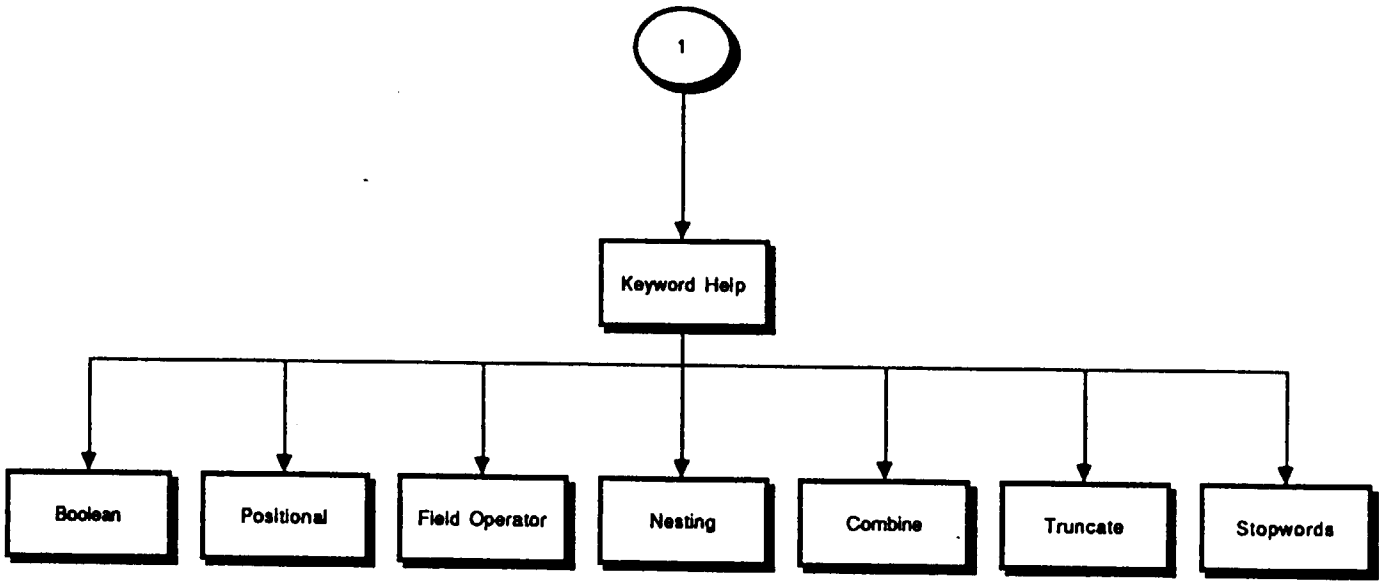


Chart 15c

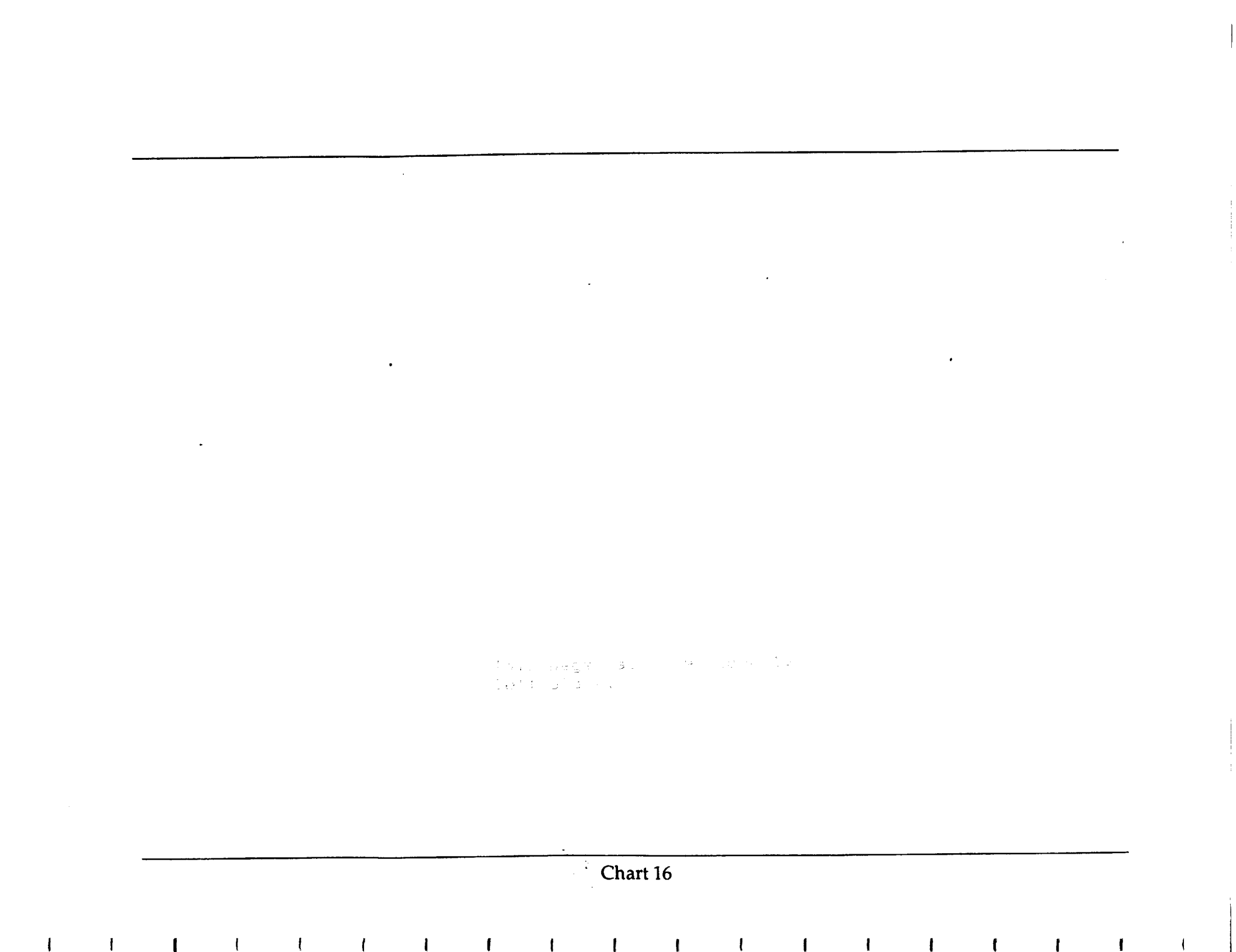


Chart 16

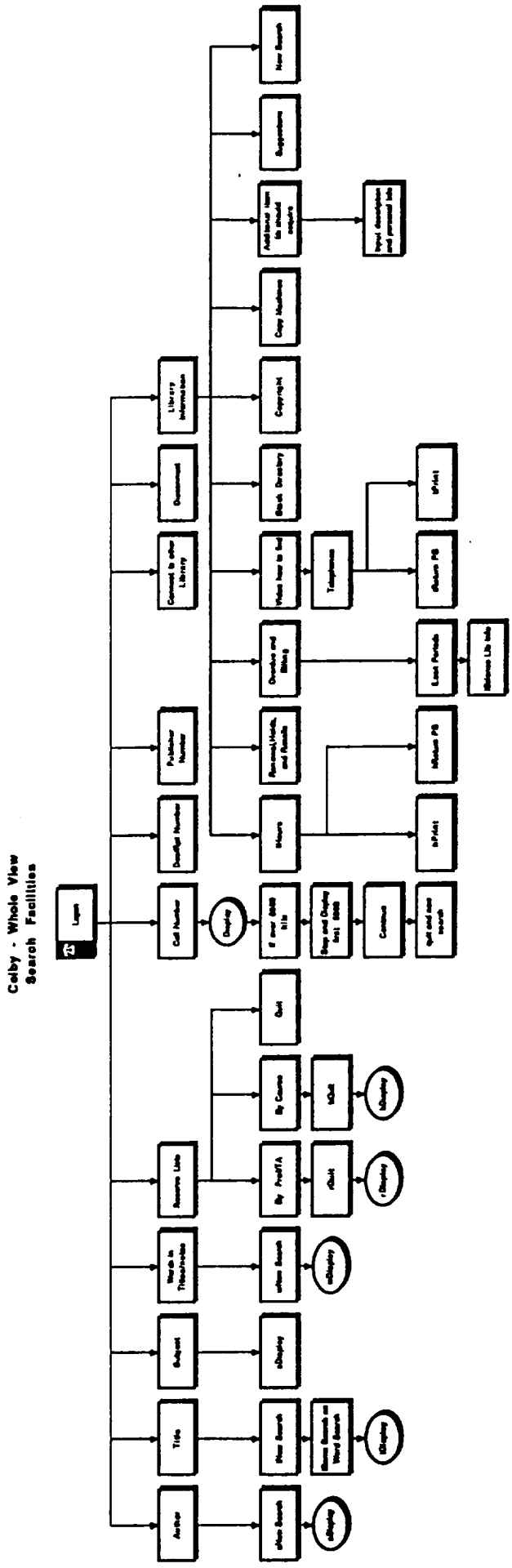


Chart 19a

CHART 16-17-18

Chart 18

Colby 1
Search Facilities

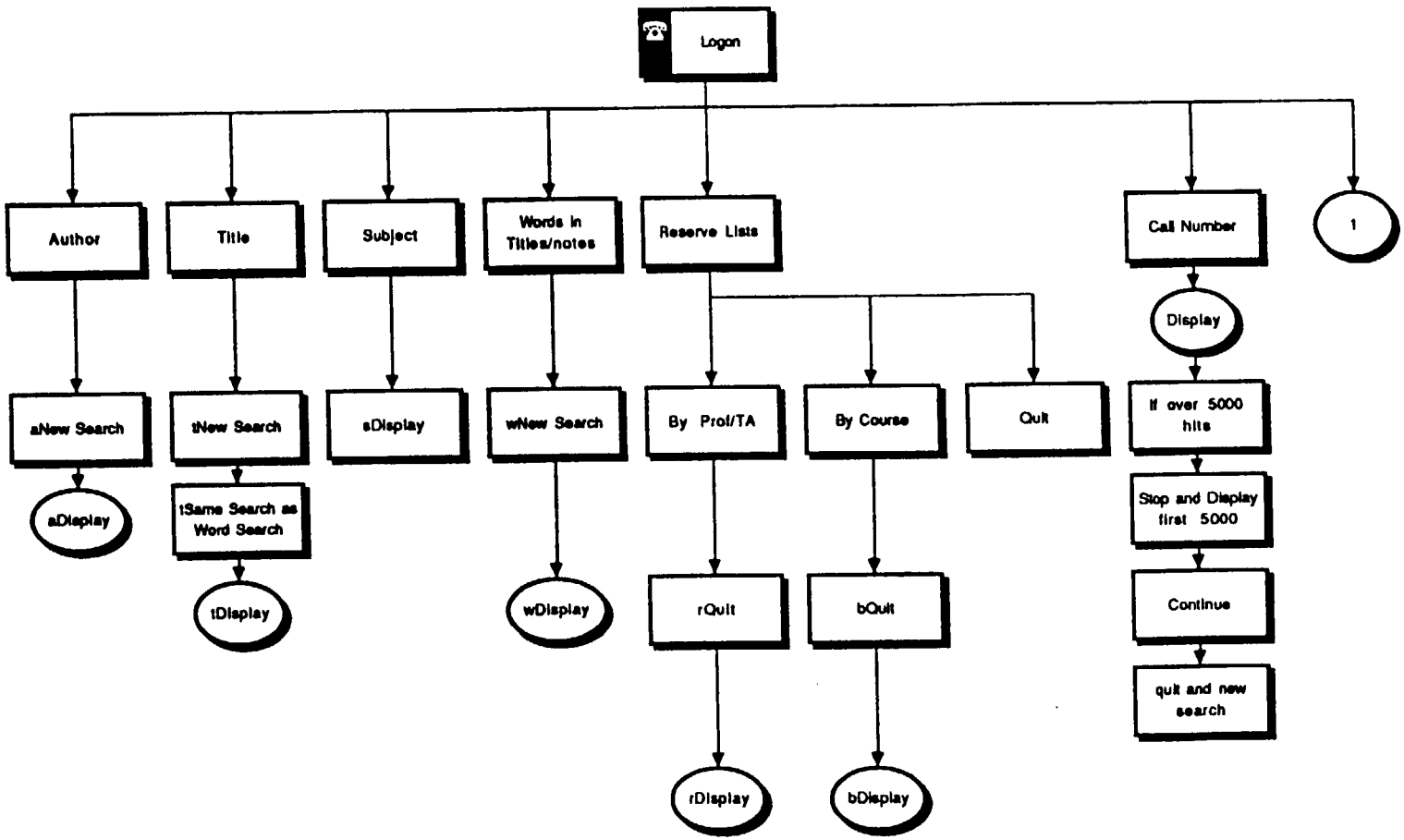


Chart 19b

Colby 2
Search Facilities

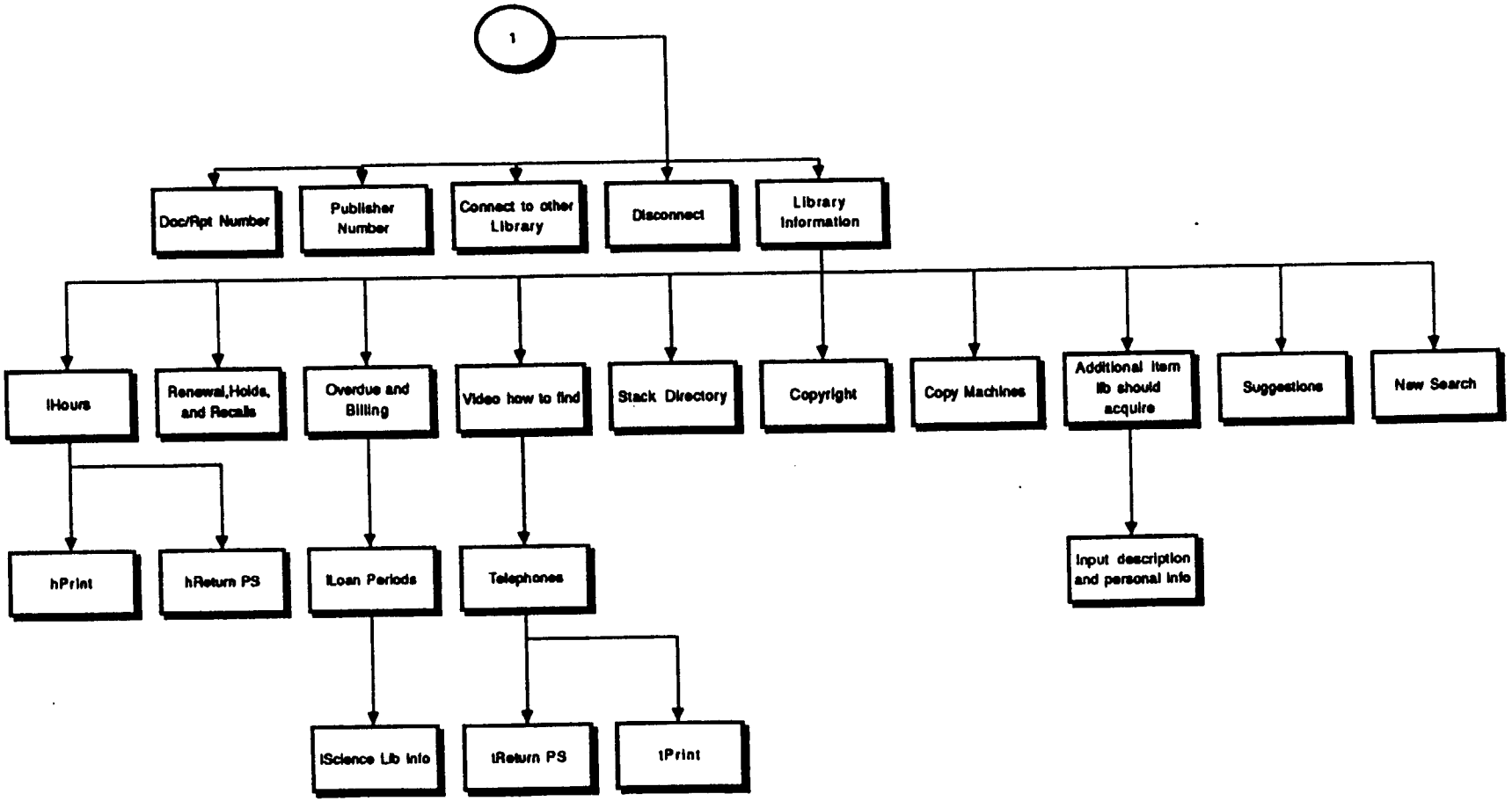
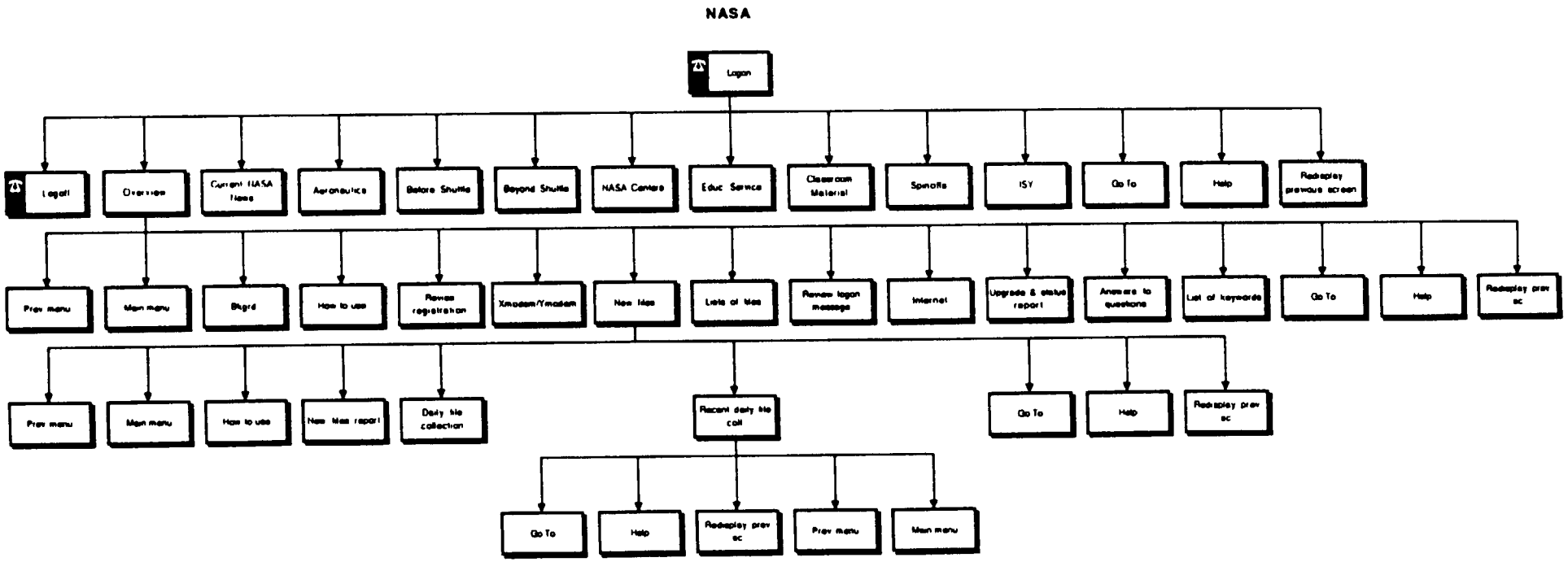
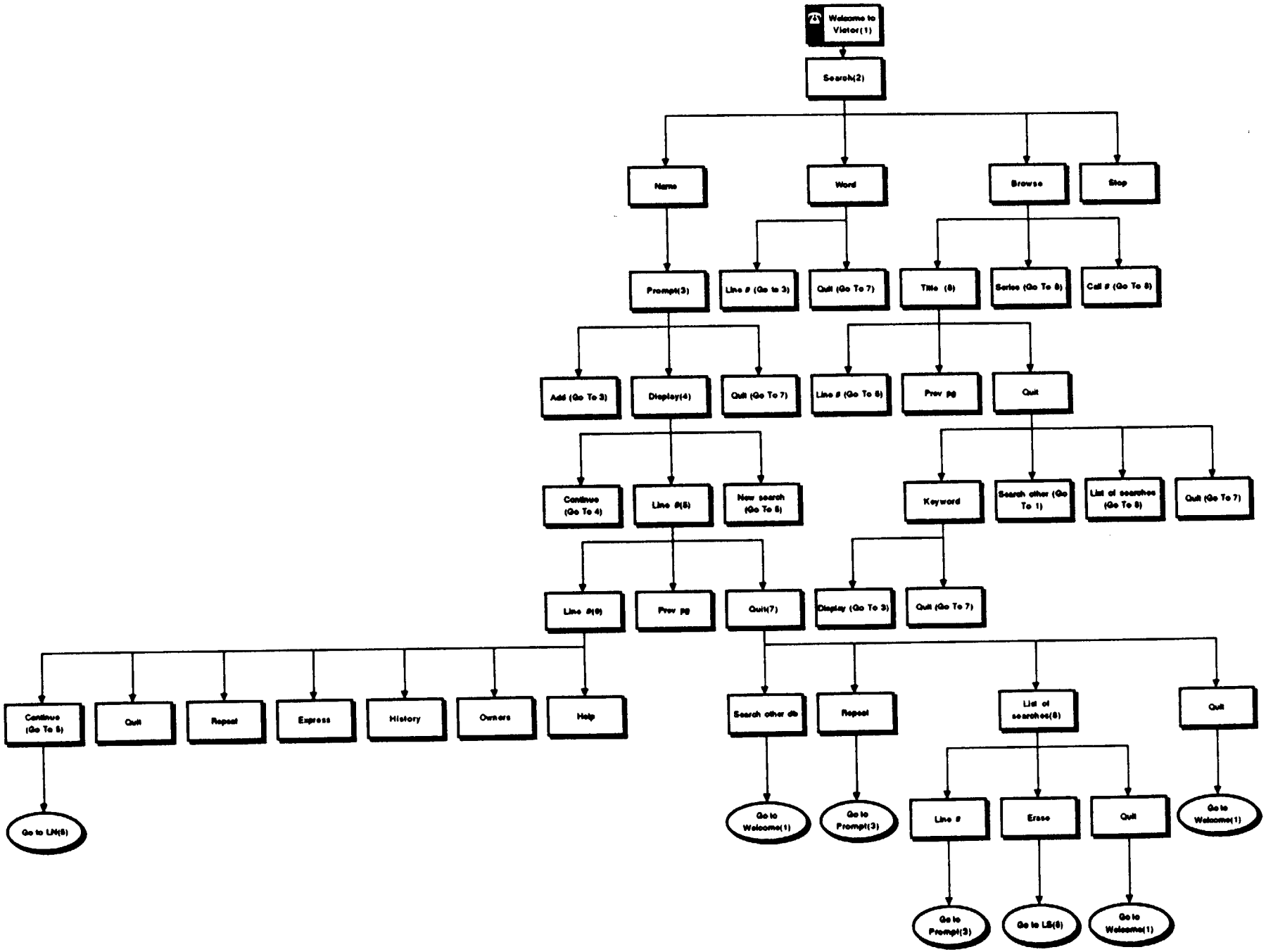
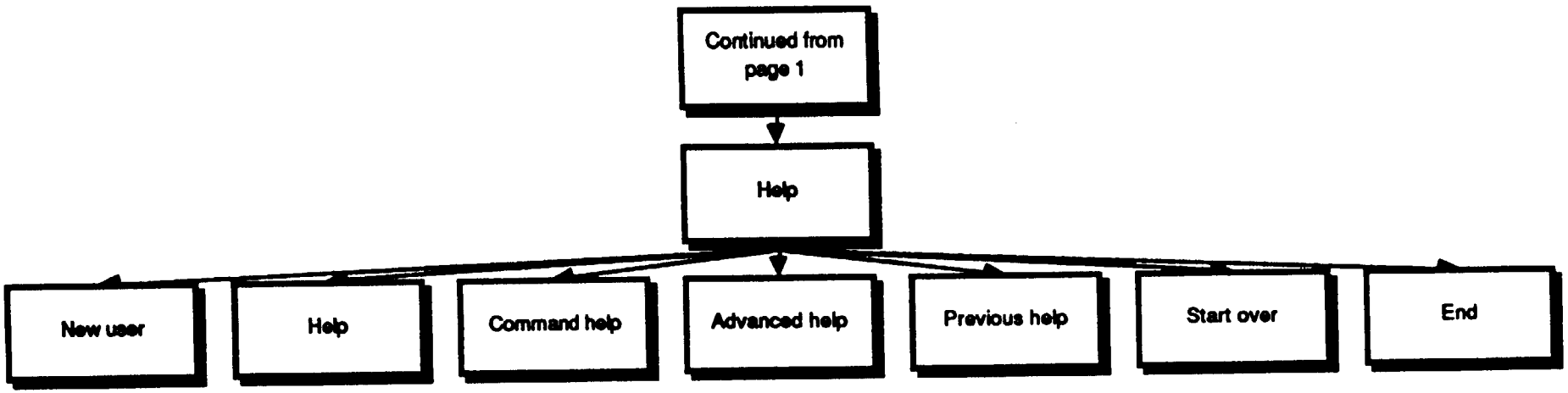


Chart 19c



University of Maryland

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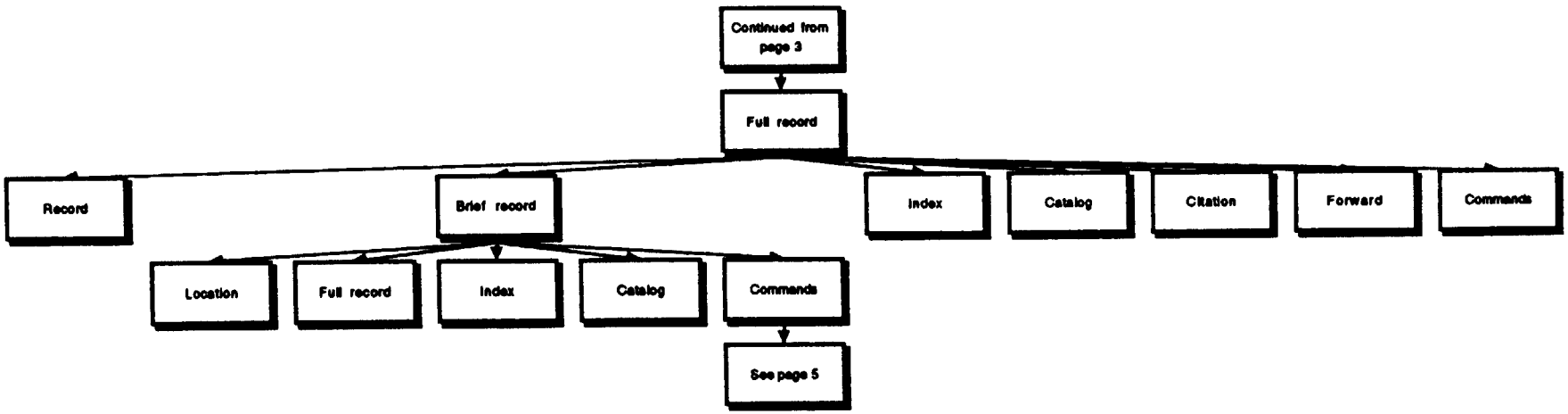
Help
New user
Help
Command help
Advanced help
Previous help
Start over
End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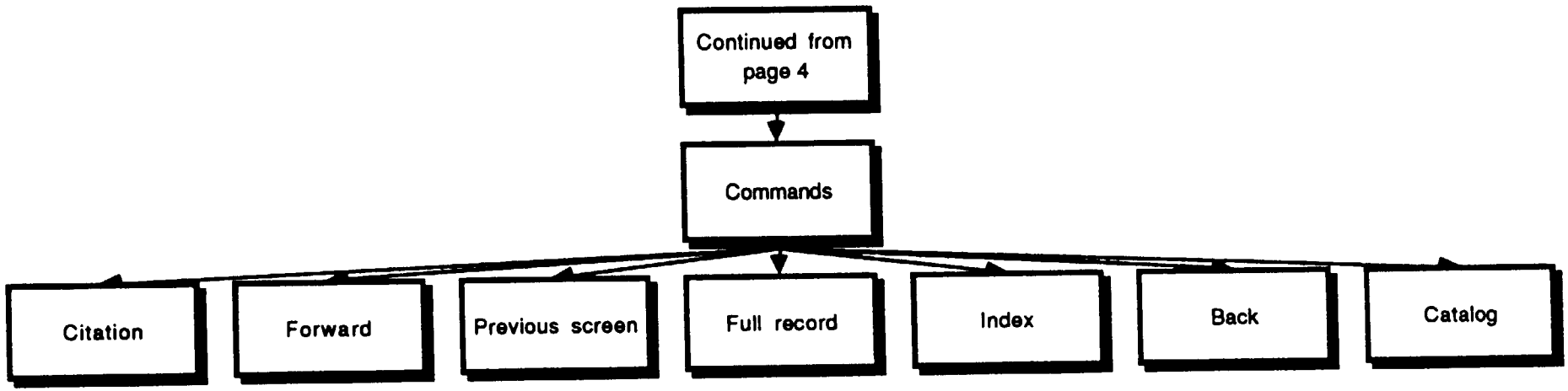
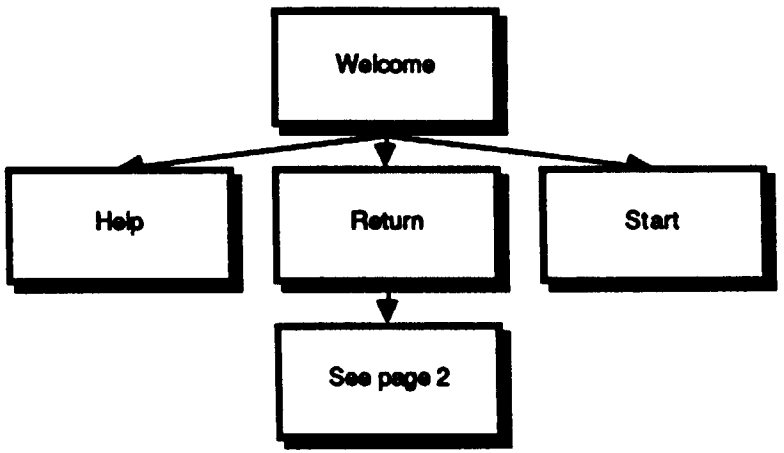
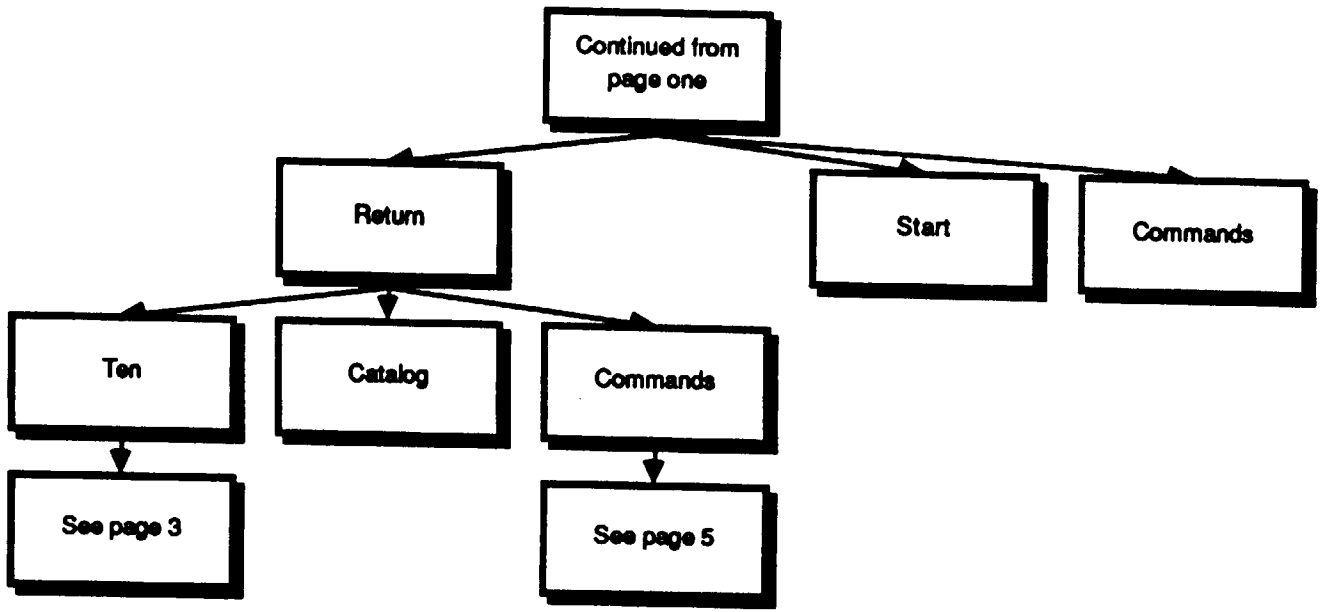
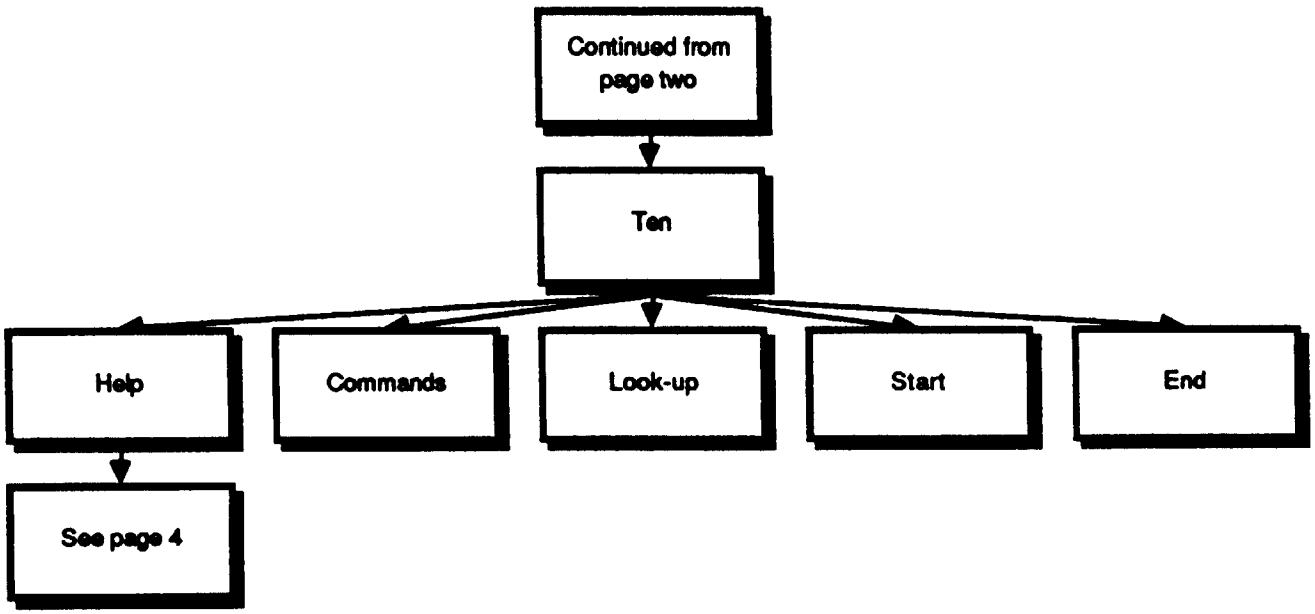
Full record
Record
Brief record
Index
Catalog
Citation
Forward
Commands
Location
Full record
Index
Catalog
Commands
See page 5




Welcome
Help
Return
Start
See page 2


Continued from page one
Return
Start
Commands
Ten
Catalog
Commands
See page 3
See page 5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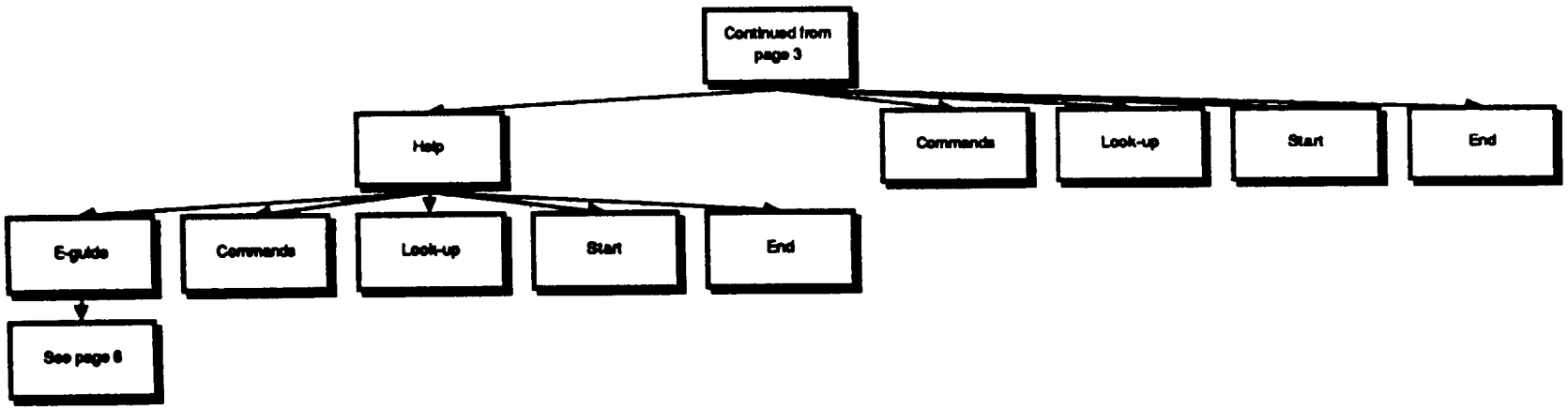
Ten
Help
Commands
Look-up
Start
End
See page 4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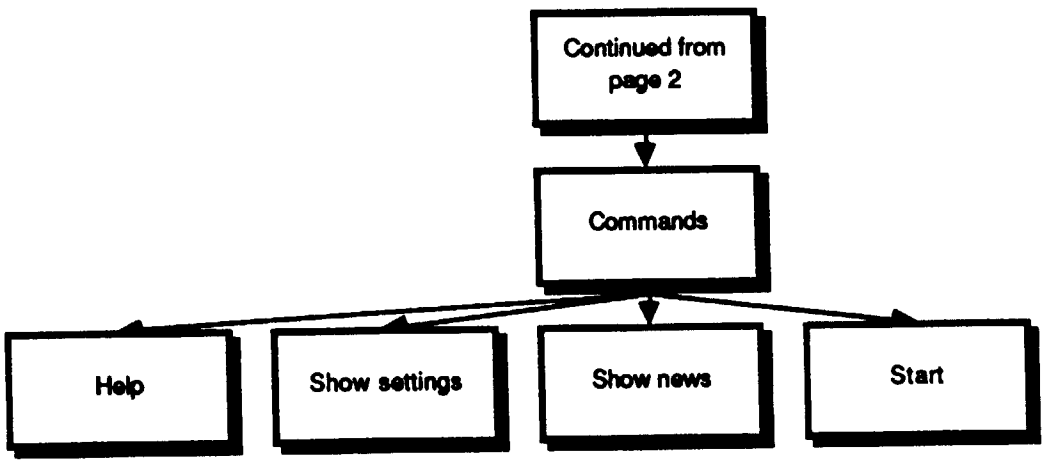
Help
Commands
Look-up
Start
End
E-guide
Commands
Look-up
Start
End
See page 6


Continued from page 2
Commands
Help
Show settings
Show news
Start

Variations in the charts within the same system differed in detail more that we anticipated, for example Indiana University (Chart 18) and the University of Minnesota (Chart 1) which were both NOTIS systems. Virginia Tech, using the VTLS system, offered both novice and expert sections. The other VTLS systems studies did not have this option. Virginia Tech and the University of North Texas both offered Boolean functions while New Mexico State University, also a VTLS system, did not offer any limiting functions or keyword searches. Colby (Chart 19) and University of Oregon (Chart 7) were both Innovative Interfaces systems but Colby lacked the extensive browsing and limiting functions offered by the University of Oregon.

After studying results from the multidimensional analysis by key features reported in Chapter 2, we concluded that the individual university systems were unique because the major systems allowed customization by the universities. Each was allowed to tailor the system to meet hardware capabilities and budget needs. A small computer trying to manipulate large quantities of data would have to limit the number of functions available while a larger machine would not have this limitation. The ability to tailor each system further explained the differences in diagramming within the major systems. We subsequently concluded that the emphasis of study should therefore be not on the groupings by major systems, but rather on the features available within each university system. The question then shifted to "which features are considered essential by the users?" The study of the diagrams was redirected to a study of the individual systems at the universities tested in the human factors surveys (Chapter 4) with emphasis on the system grouping being secondary. Varimax rotation was used to group the features contributing to the satisfaction rating of the system. The satisfaction rating was determined by a combination of four questions describing overall satisfaction with use of the system. Seven factors were identified through

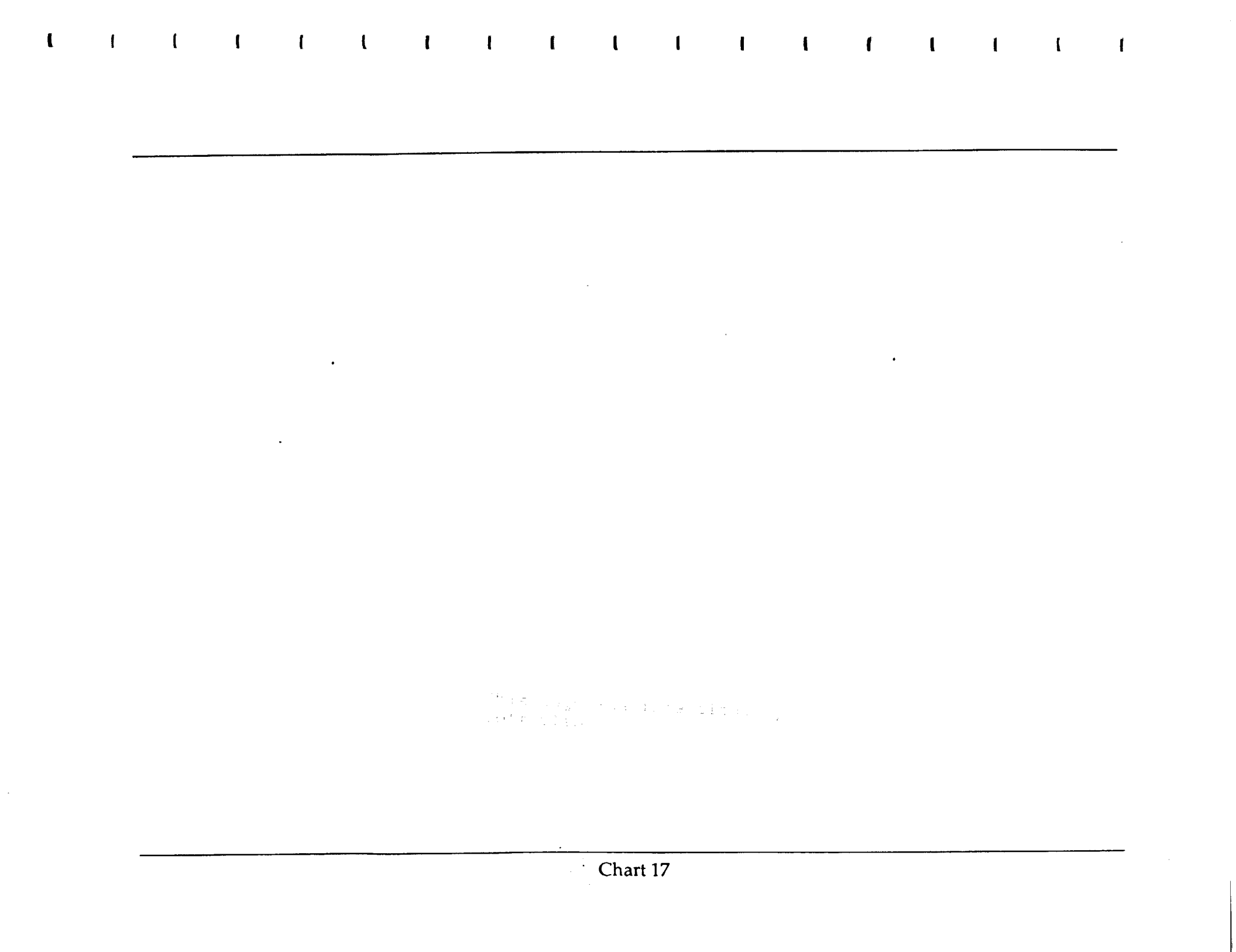
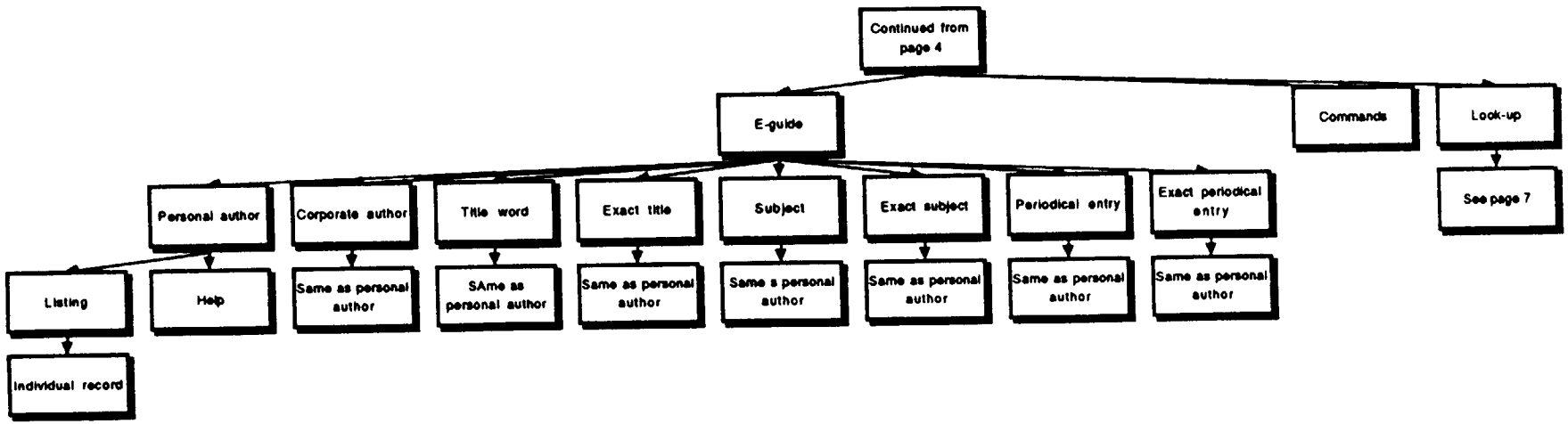
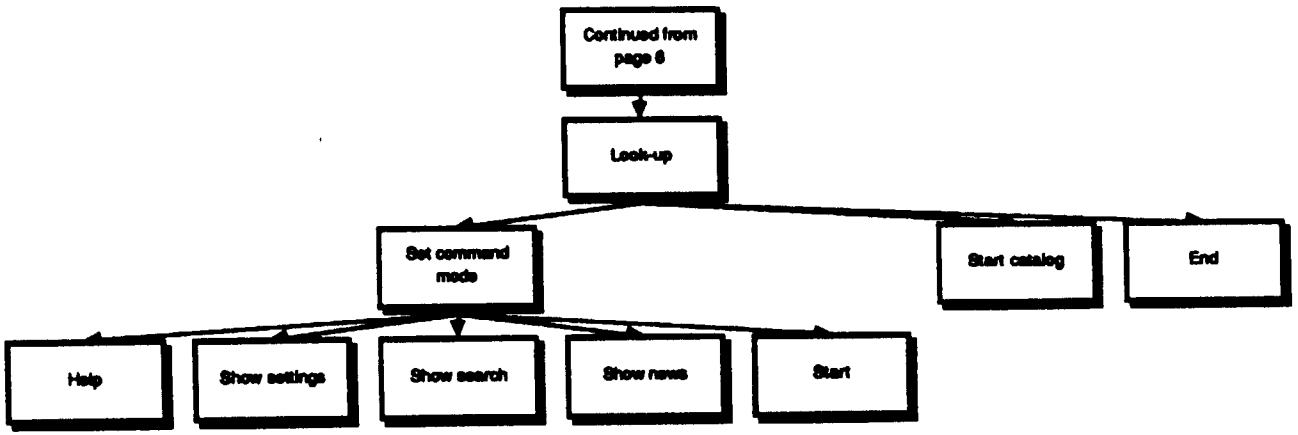
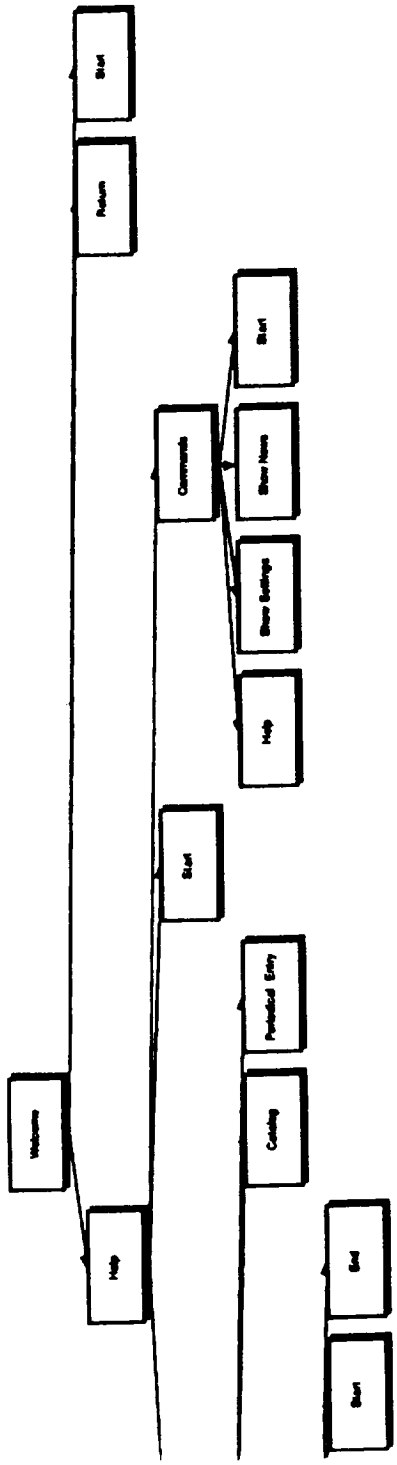


Chart 17


Continued from page 4
E-guide
Commands
Look-up
See page 7
Personal author
Corporate author
Title word
Exact title
Subject
Exact subject
Periodical entry
Exact periodical entry
Listing
Help
Same as personal author
SAme as personal author
Same as personal author
Same s personal author
Same as personal author
Same as personal author
Same as personal author
Individual record


Continued from page 6
Look-up
Set command mode
Start catalog
End
Help
Show settings
Show search
Show news
Start

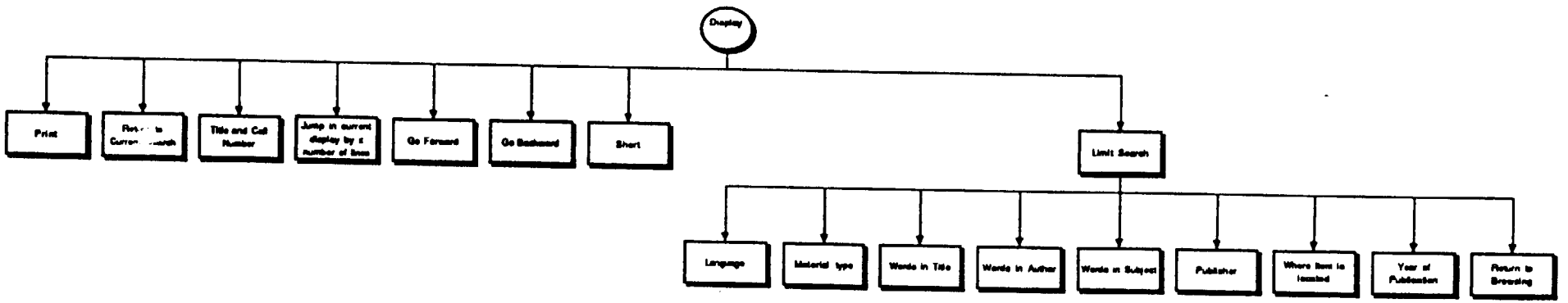


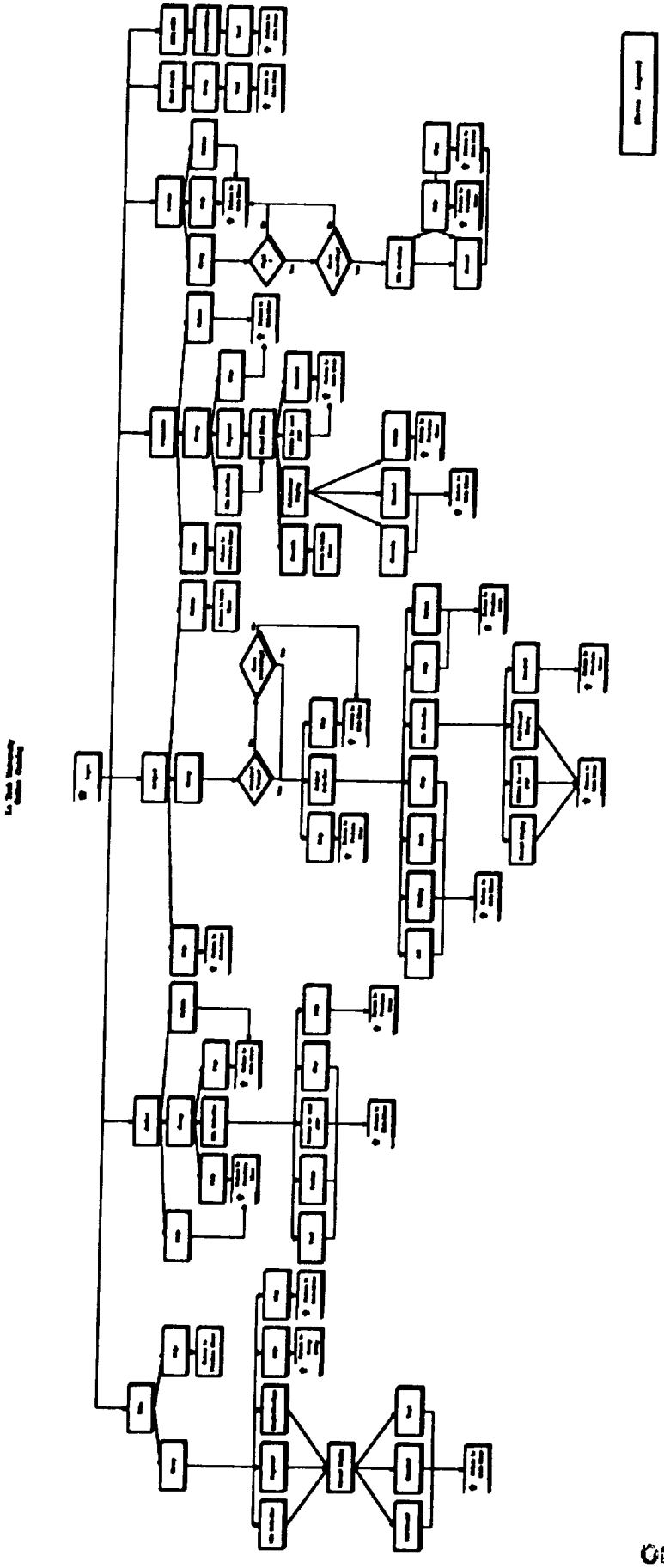
the analysis of the rotated factor pattern. The consequent features in these factors resulted in the naming of the factors as Instructions, Error, Help, and Display. Combining these results with the results from the multidimensional analysis (Chapter 2), we concluded that the structure of the system was not as important as the explicit features available. The charts were then studied by features.

The system used by the University of Nevada at Las Vegas (Chart 20), ranked as the most satisfactory by the students in the human response survey, exhibited the most depth in the charting. A number of options were available to the user at deeper levels while the options at the first level were limited to the main search tools: author, title, subject, call number, keywords, reserve lists, and library information. The ability to move backward and forward in the displays was available at the display of results from a search. Browsing was available at many levels with the option added to show nearby items or show items with same subject. Displays from searches were shown with the option to move to a nearby item, start new search, limit search, print, or jump back or forward. The Limit Search function offered nine options. The University of Oregon system (Chart 7) charting looked very similar to UNLV, but the Colby system (Chart 19) had many more features at the first level. The Colby system added breadth to the depth of these Innovative Interface systems, but lacked features such as browsing and limiting search.

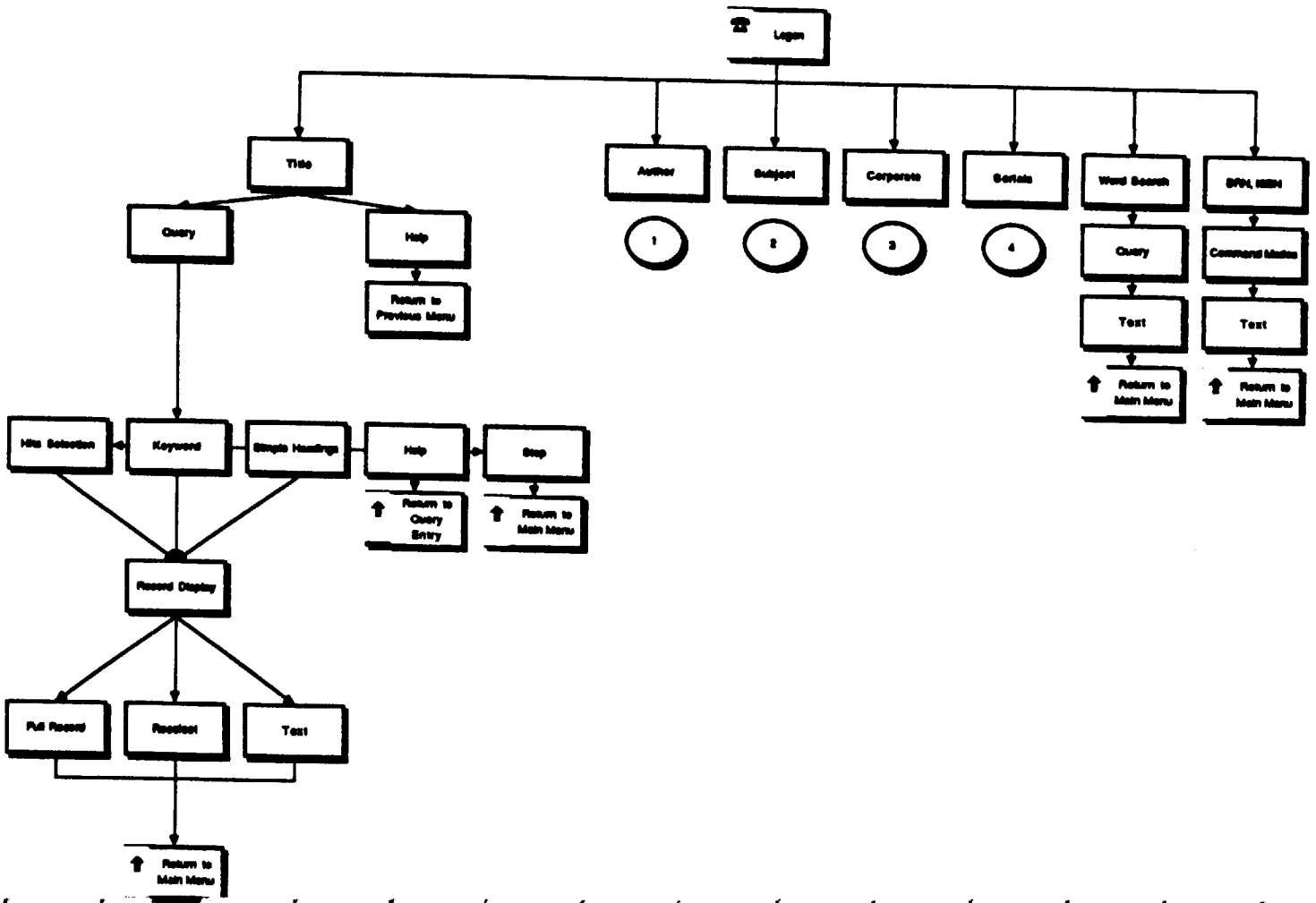
Boston University (Chart 9), ranked second in satisfaction in the human response survey, exhibited a simple diagram showing very little breadth or depth. Features such as print and search nearby were missing from this system. Title, Author and Subject were offered at the second level with limiting features hidden further in the system until needed. This diagram demonstrated the simplicity in a system that also has the attribute of accessing more powerful functions when needed.

Colby 3
Display Facilities



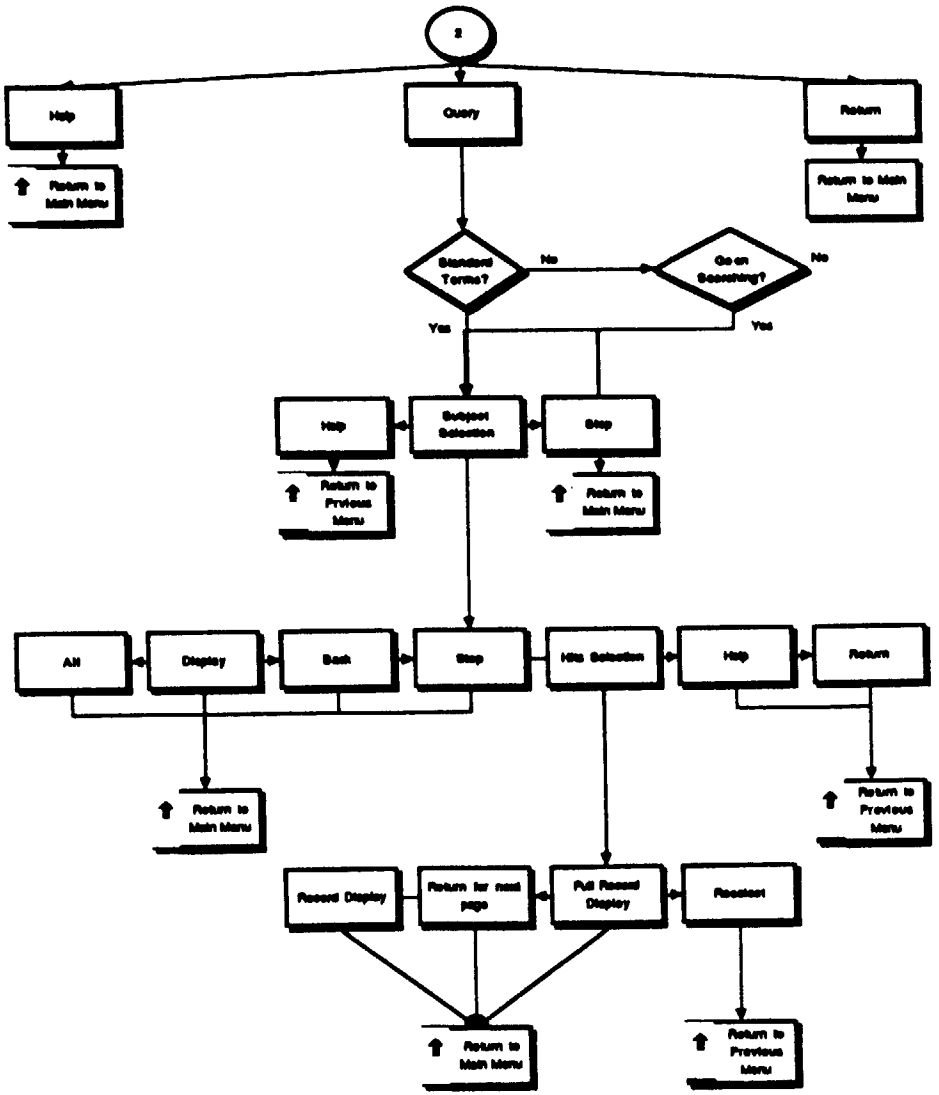


La Trob University
Online Catalog - 1



La Trob University
Online Catalog - 2

La Trob University
Online Catalog - 3



Dartmouth (Chart 10a), ranked third in satisfaction in the human response survey, appeared from the chart to be a broad system with little depth. Upon closer investigation however, the system options varied with the results of the search and type of search, therefore resulting in a much deeper chart. An extensive "Explain" section (Chart 10c) was offered containing as much depth as the search section itself. The use of the unique "Explain" function resulted in a different charting from other systems in that the user could always access the function temporarily and then return to the originating screen. Functions such as browse and display modes were also offered with the Dartmouth system.

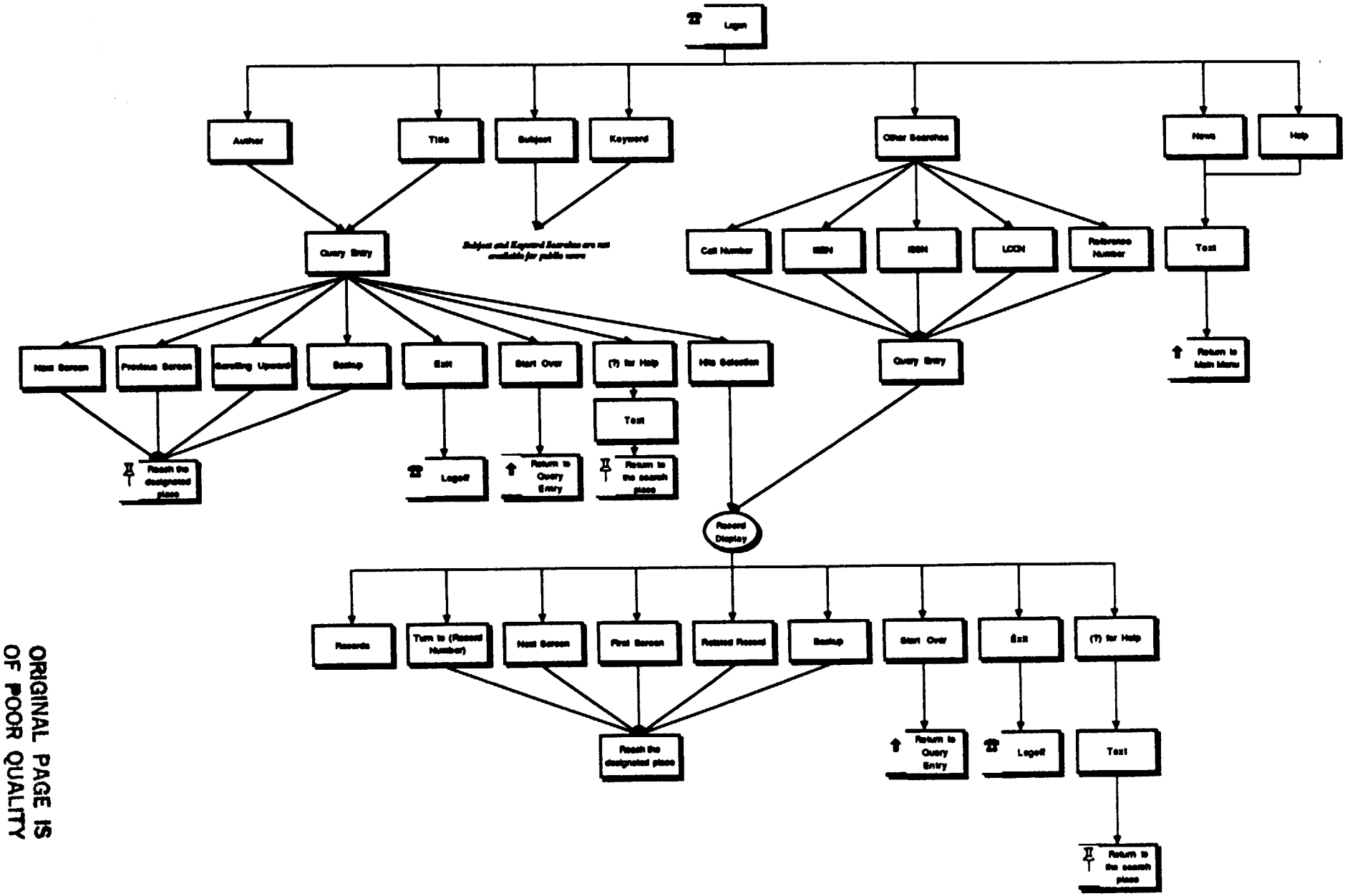
The Rockefeller University system (Chart 21), ranked last by the responders, seemed to present options only for Keyword and New Book Lists. All paths for author, title, and subject led to the record display and also ended there. The diagram indicated that the system did not have much to offer the novice user since features were not available at the author, title or subject level.

Chart 20

La Trob University
Online Catalog - 4

Library of Congress

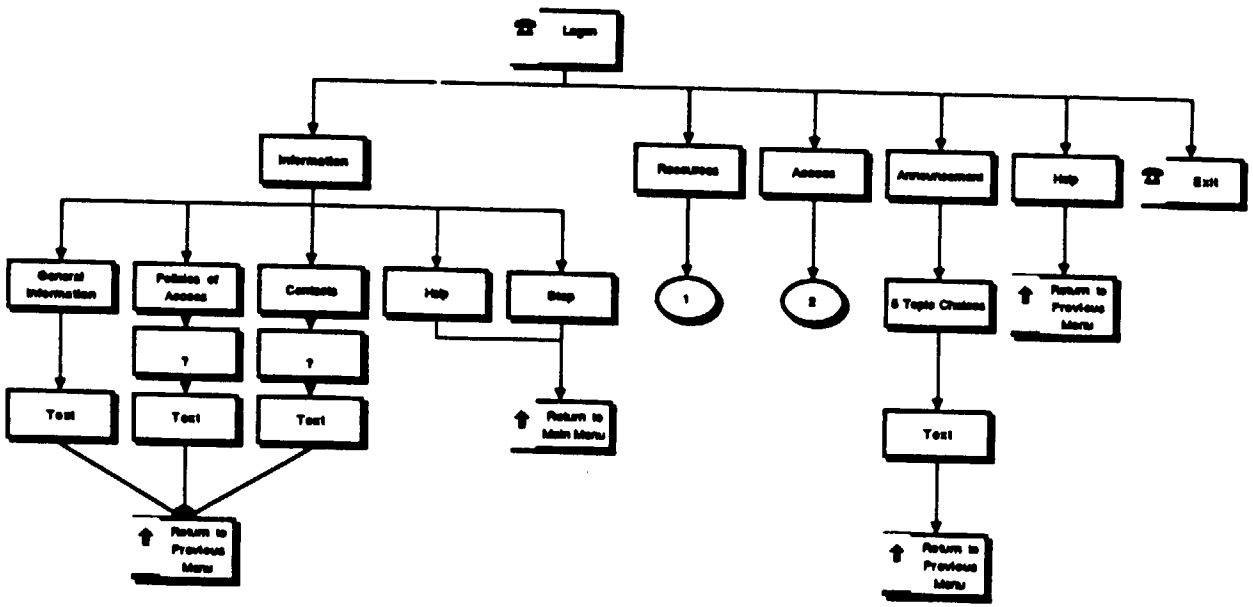
Data Research Association Inc.



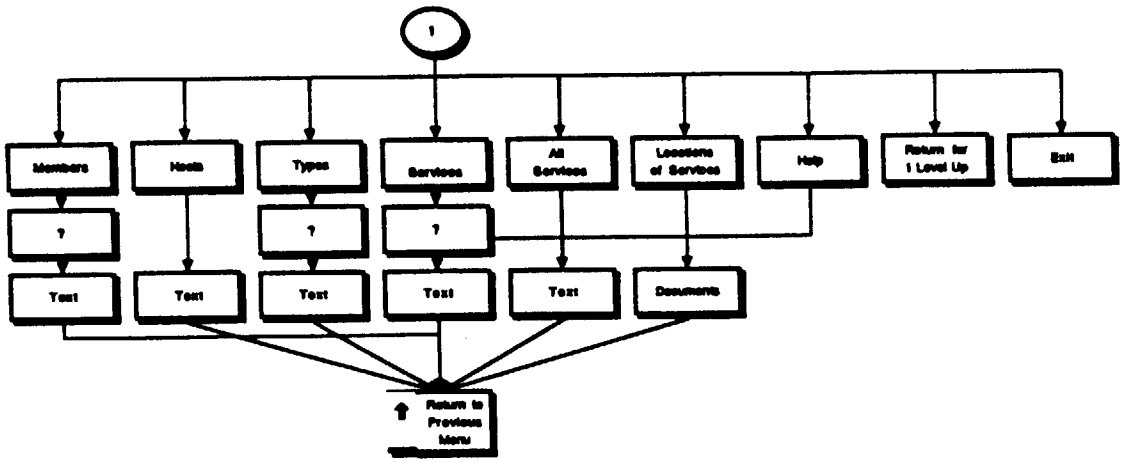
ORIGINAL PAGE IS
OF POOR QUALITY

Michigan University Online Consotium

(MERIT) - 1



(MERIT) - 2


1
Members
Hosts
Types
Services
All Services
Locations of Services
Help
Return for 1 Level Up
Exit
?
?
?
Text
Text
Text
Text
Text
Documents
Return to Previous Menu

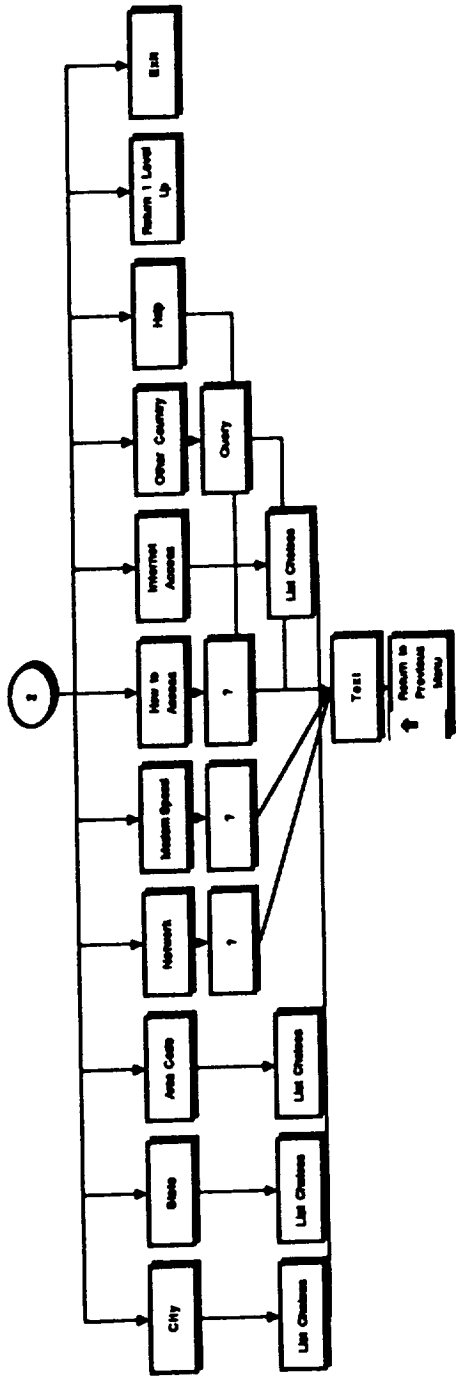
CONCLUSION

Since only five systems were evaluated by the responders, similar systems to the five evaluated might be assessed to determine if the actual structure of the system is important. It was our opinion that the structure was not as important as the actual features available to the users. For example, the systems ranked highest for satisfaction varied considerably in their structure. UNLV system contained depth to the structure while Boston University system evolved from a simple structure that was neither broad nor deep. Dartmouth was derived from an even broader system. The two lowest ranking systems lacked functions and features at the novice level leading us to conclude that if the features were available, the users were not able to access them due to lack of instructions or help.

The desirability of the system appeared to be correlated more closely with the available features than with the flow of the system. The consistency of the groupings in the rotated factor analysis (Chapter 3) showed that on-screen instructions, error treatment, on-line help and display methods accounted for 76% of the satisfaction score of the system. After studying the charts, we found very little visual correlation between the flow of the system and satisfaction therefore concluding that emphasis during the design phase should be placed on availability of desired features.

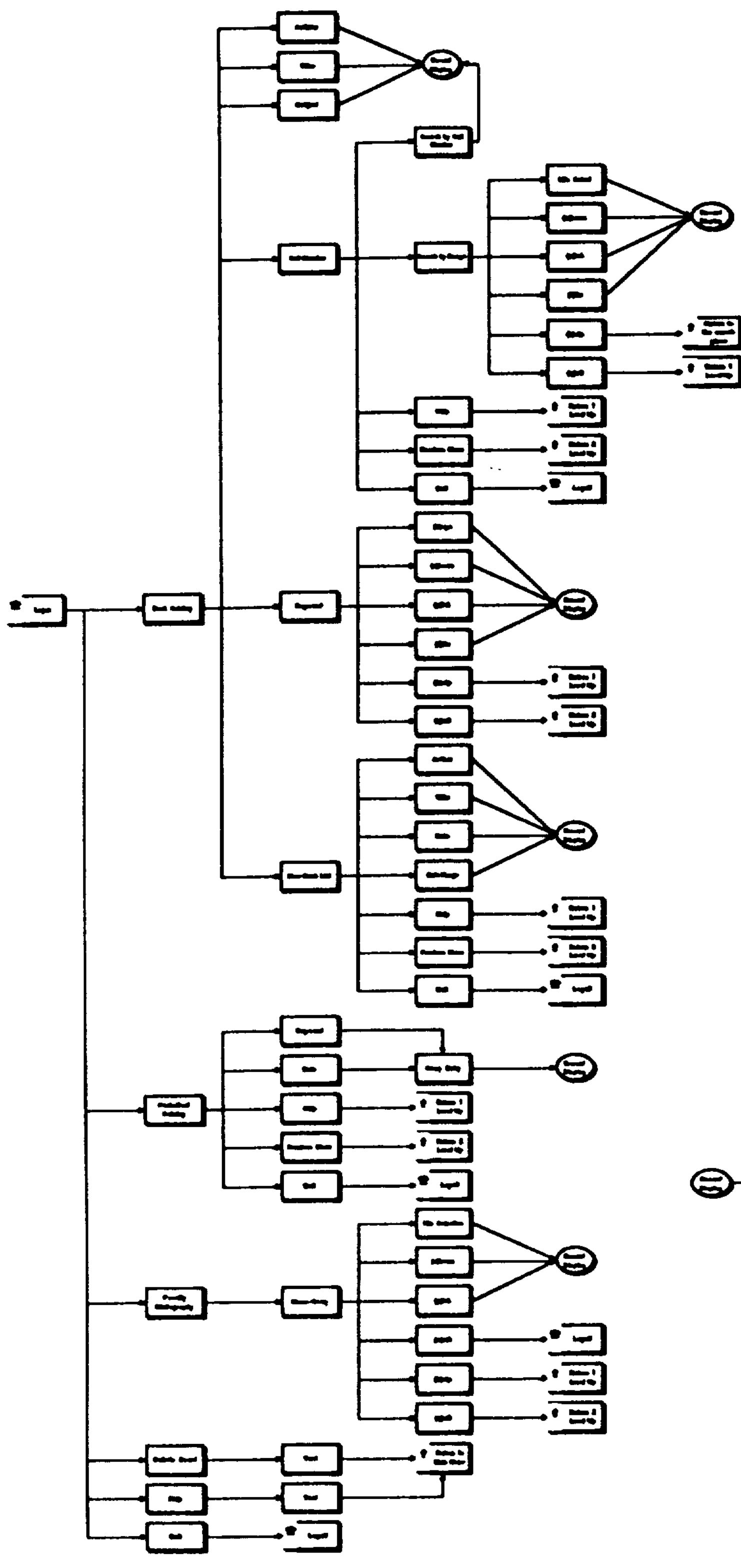
Using a survey of five systems, Chapter 3 uses stepwise regression methods to detect the features most closely related to the satisfaction of the systems. Varimax rotation was used to determine if the features grouped into categories. The results (as described in Chapter 3) identify four major categories that contained features the participants in the survey desired: Instructions, Error Detection, Help, and Display. We concluded that these features would be significant to the designers of future systems.

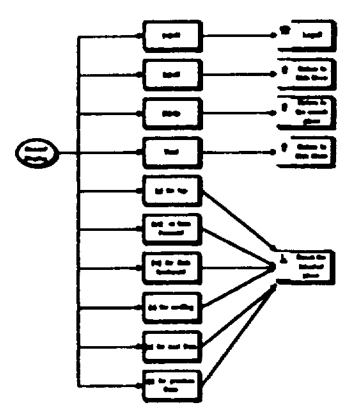
Chart 21



(MERIT) - 3

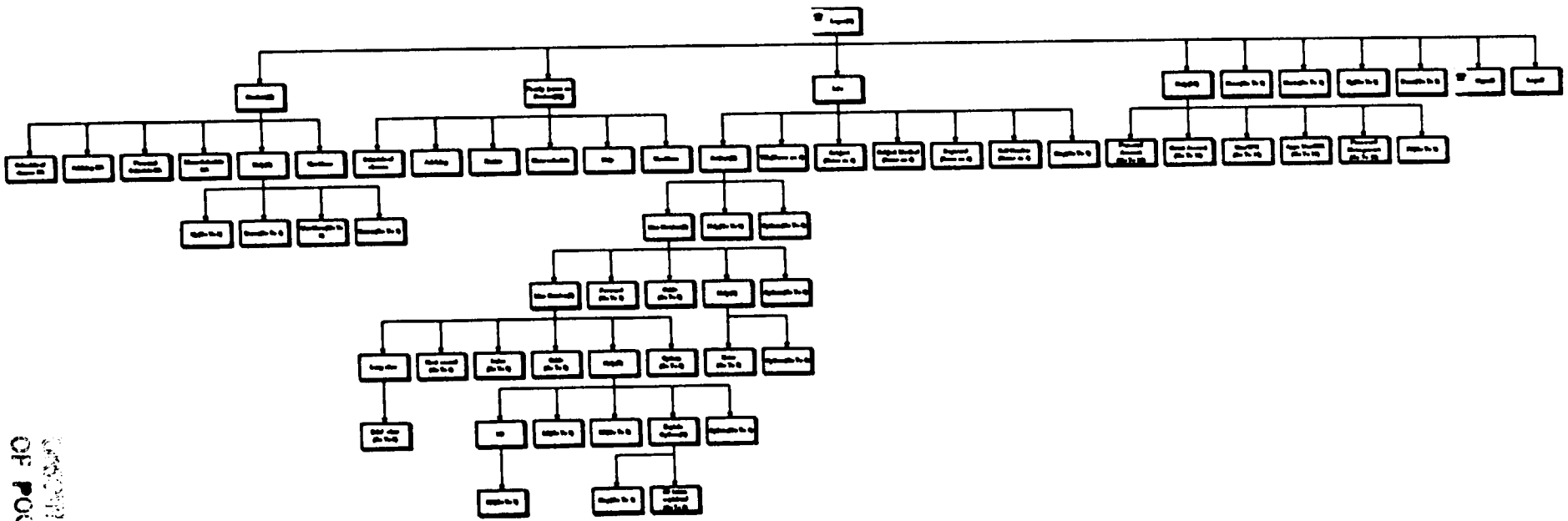
[illegible] University Library
Online Catalog



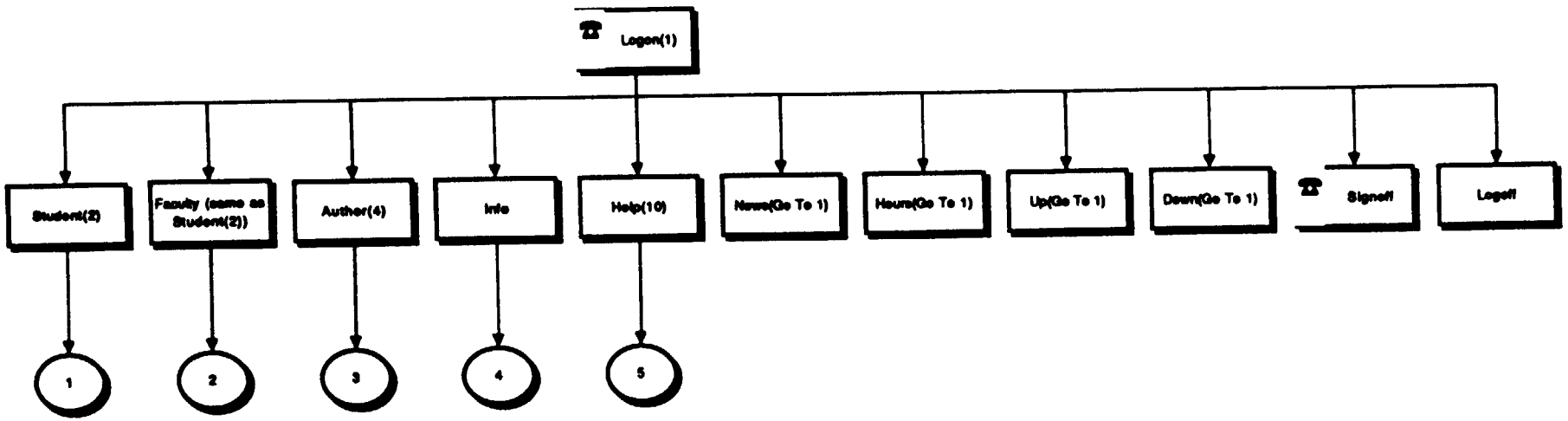


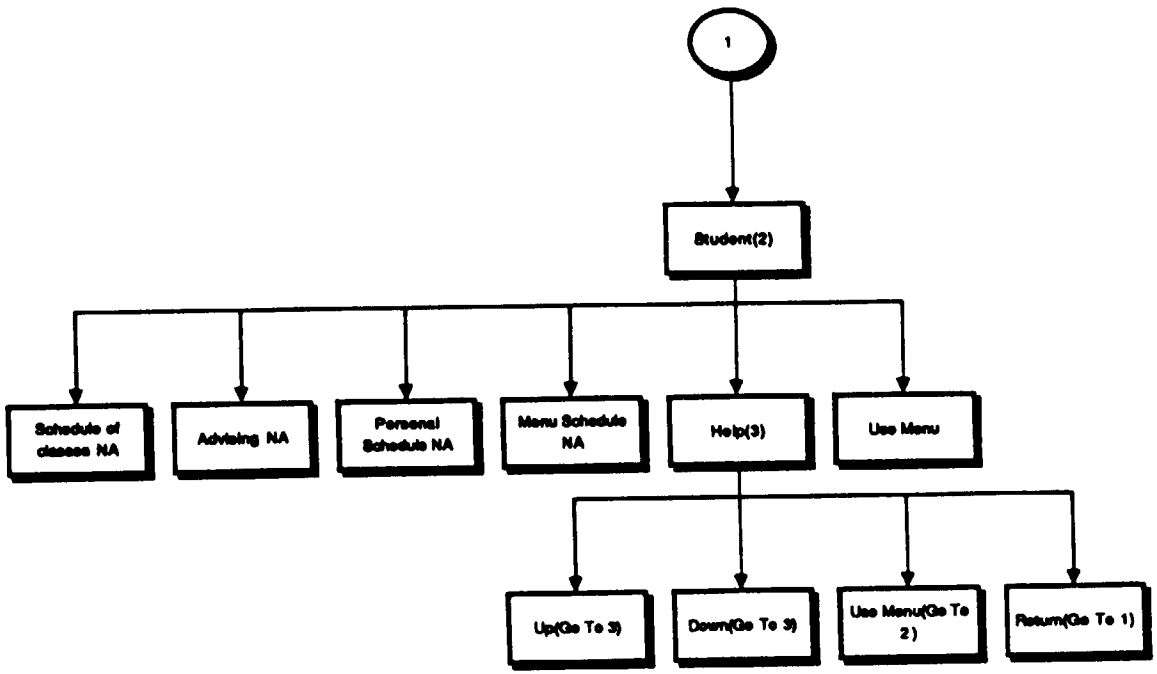
(Six Levels)

Indiana University - 1
Whole View

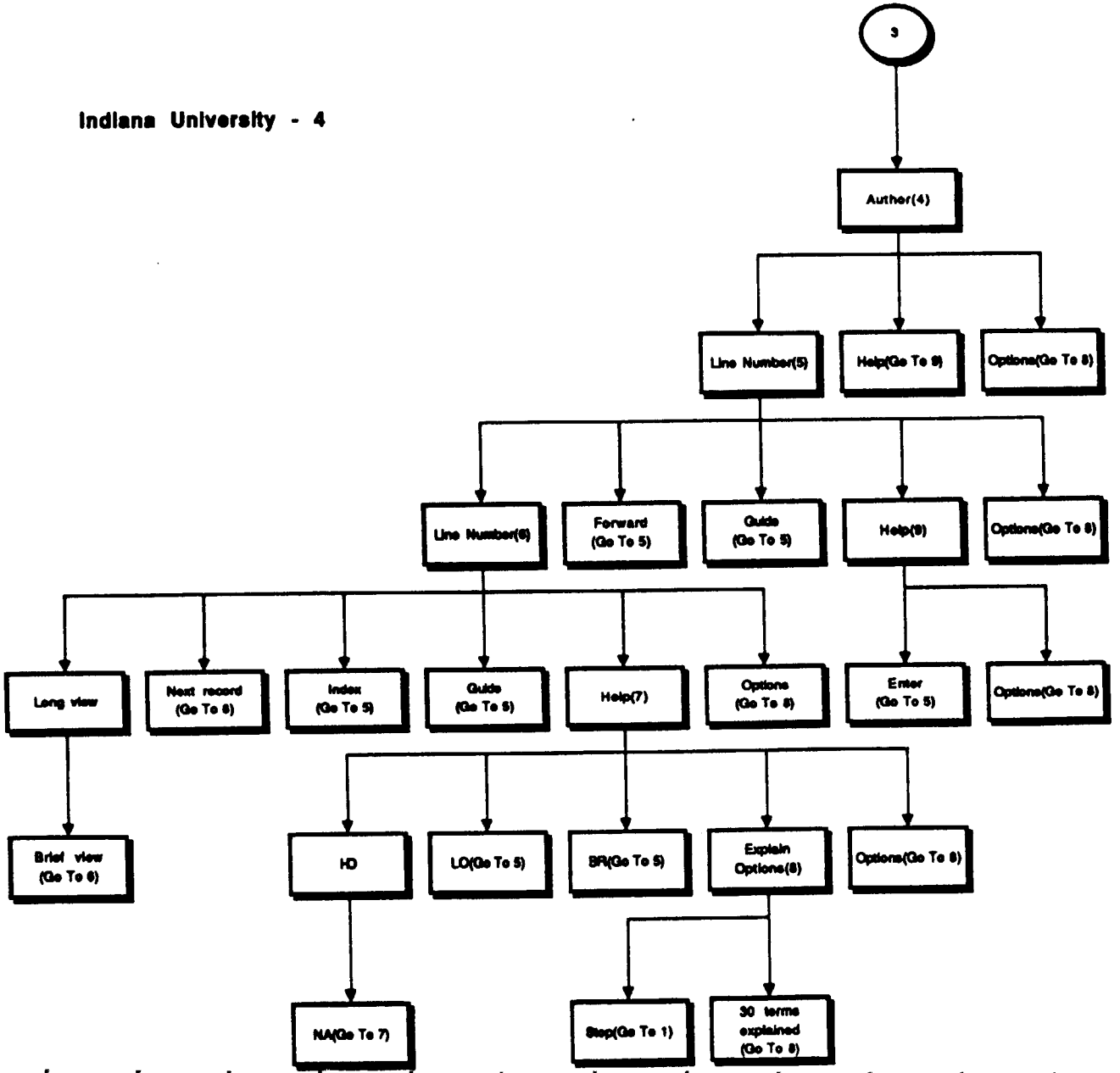


Indiana University - 2

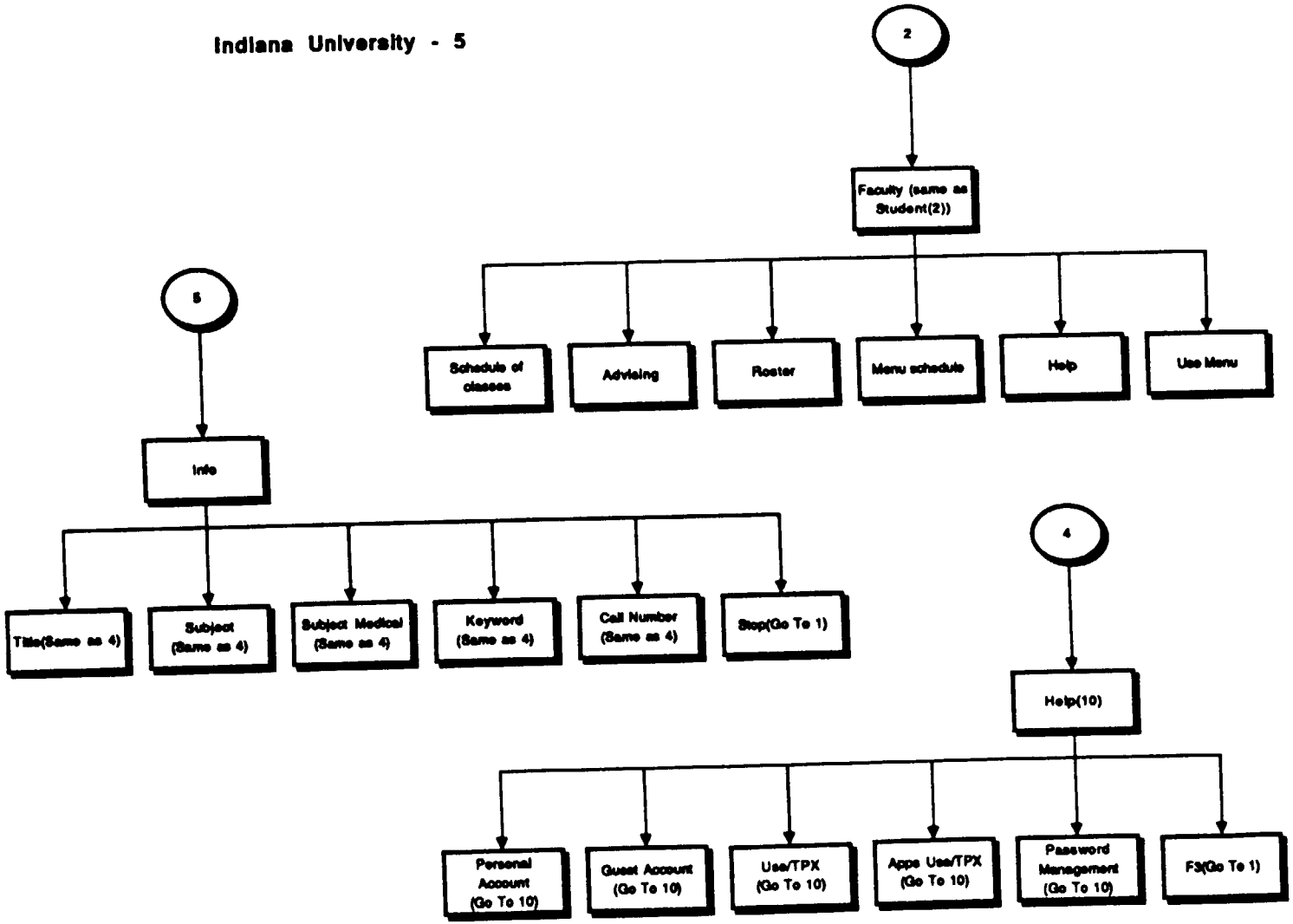




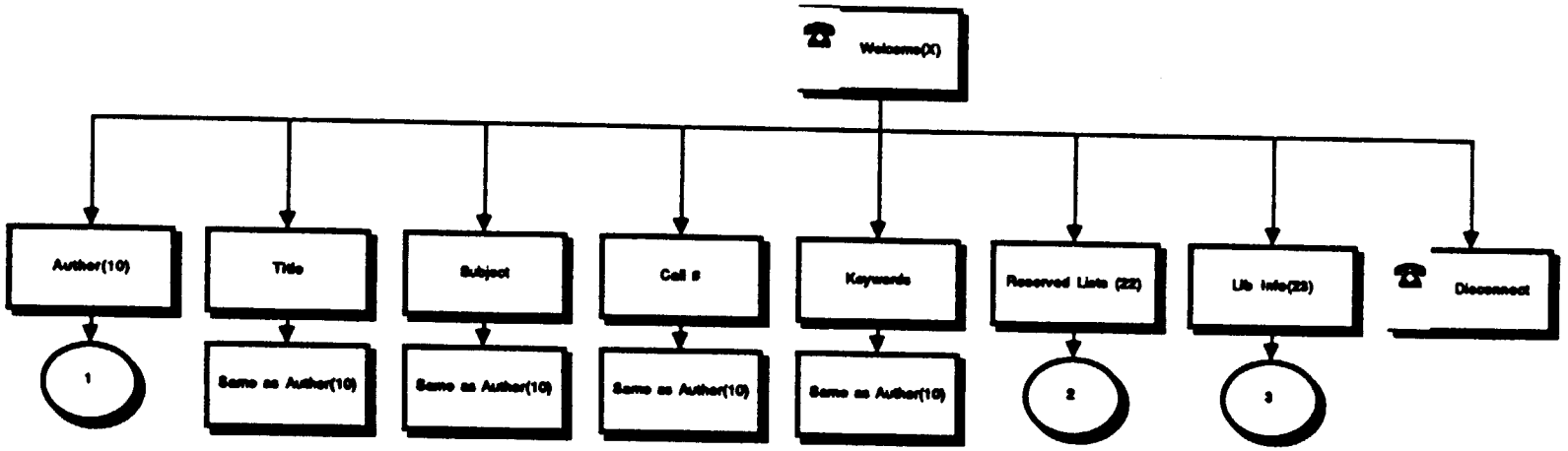
Indiana University - 4

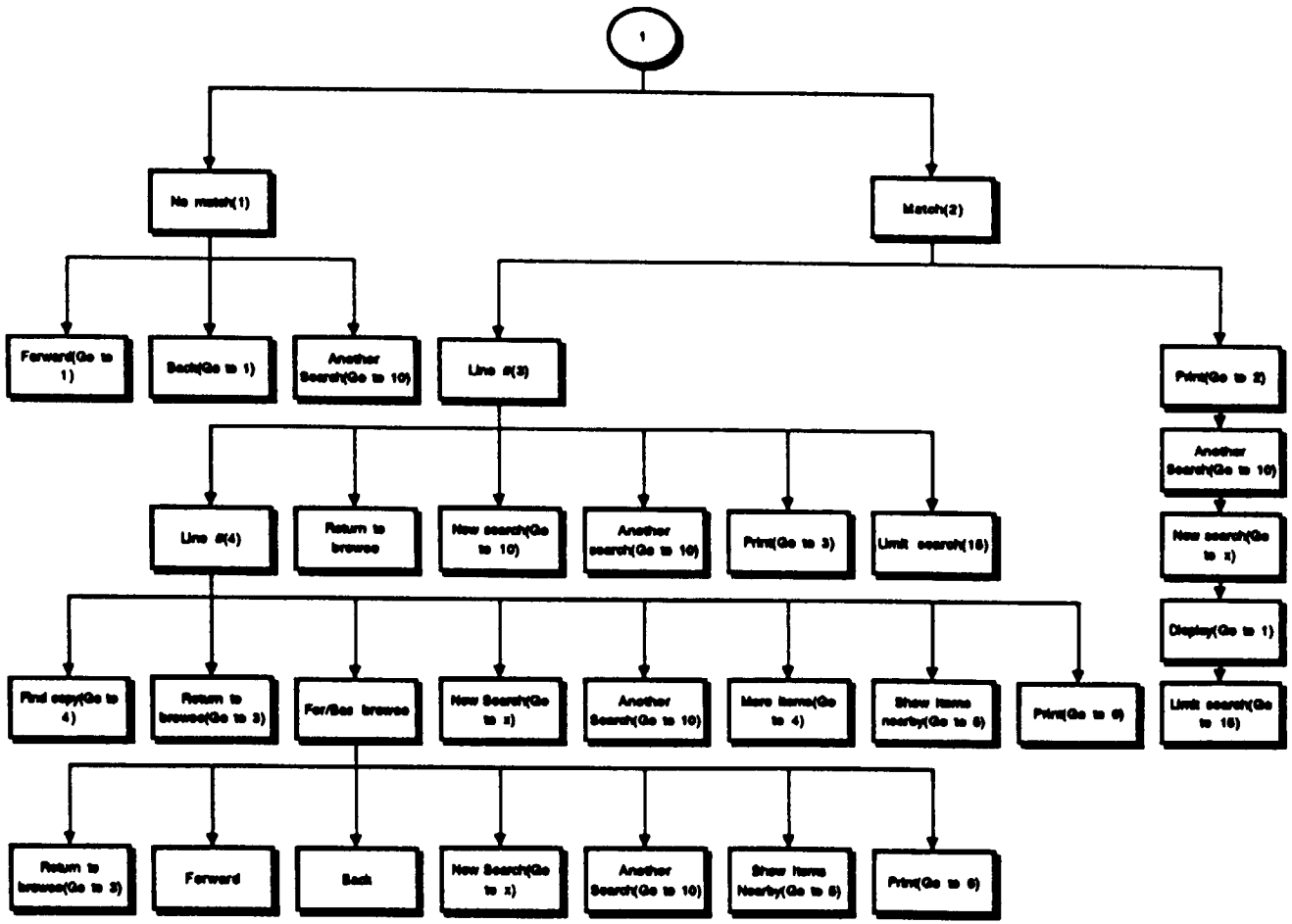


Indiana University - 5

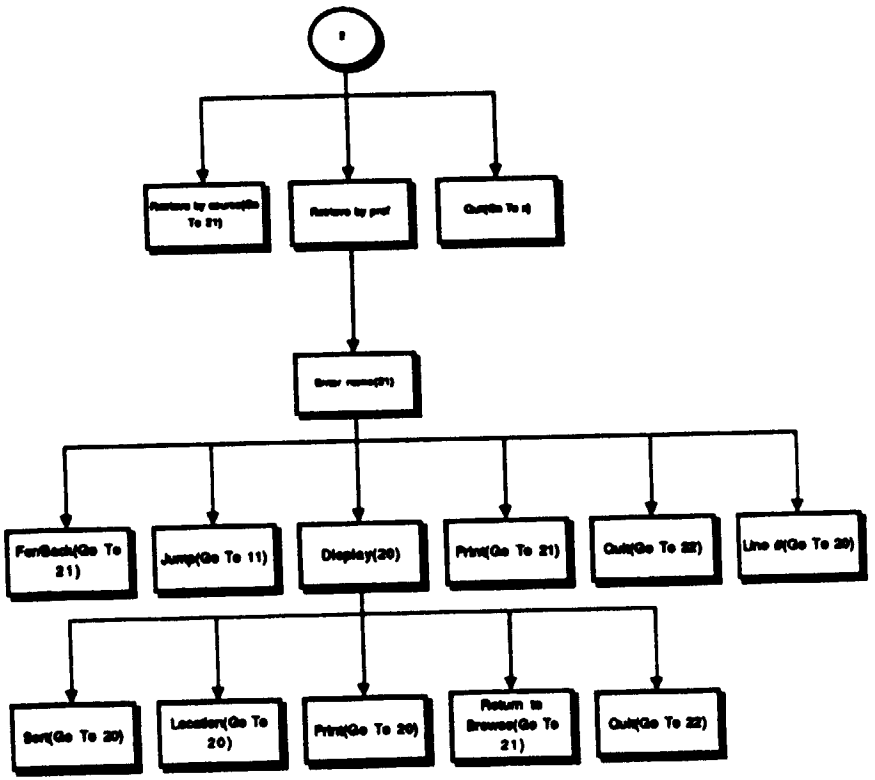


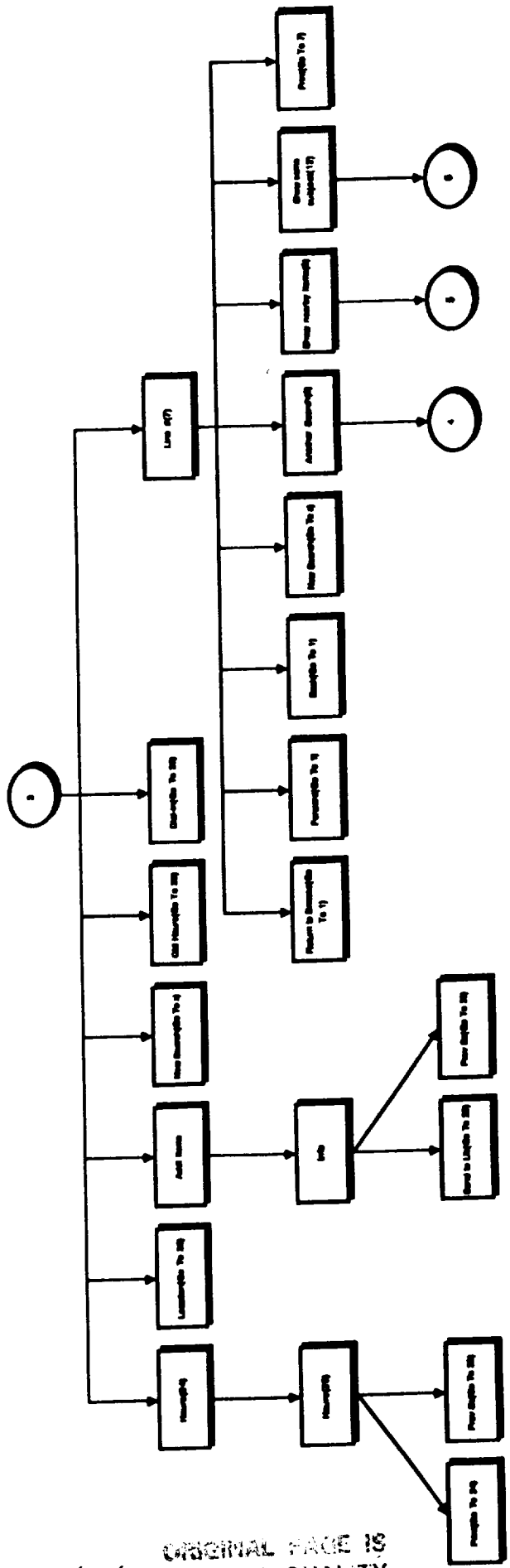
UNLV -1

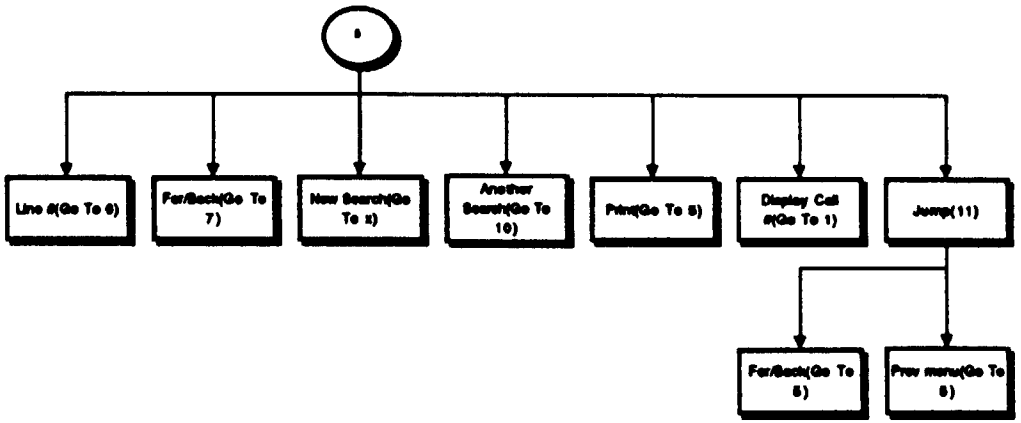

Welcome(X)
Author(10)
Title
Subject
Call #
Keywords
Reserved Lists (22)
Lib Info(23)
Disconnect
1
Same as Author(10)
Same as Author(10)
Same as Author(10)
Same as Author(10)
2
3

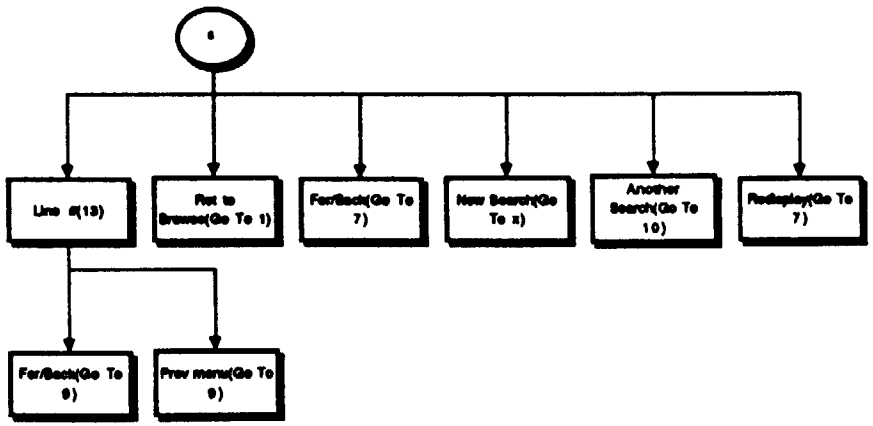

1
No match(1)
Match(2)
Forward(Go to 1)
Back(Go to 1)
Another Search(Go to 10)
Line #(3)
Print(Go to 2)
Another Search(Go to 10)
New search(Go to x)
Display(Go to 1)
Limit search(Go to 15)
Line #(4)
Return to browse
New search(Go to 10)
Another search(Go to 10)
Print(Go to 3)
Limit search(15)
Find copy(Go to 4)
Return to browse(Go to 3)
For/Bac browse
New Search(Go to x)
Another Search(Go to 10)
More items(Go to 4)
Show items nearby(Go to 5)
Print(Go to 6)
Return to browse(Go to 3)
Forward
Back
New Search(Go to x)
Another Search(Go to 10)
Show items Nearby(Go to 5)
Print(Go to 6)

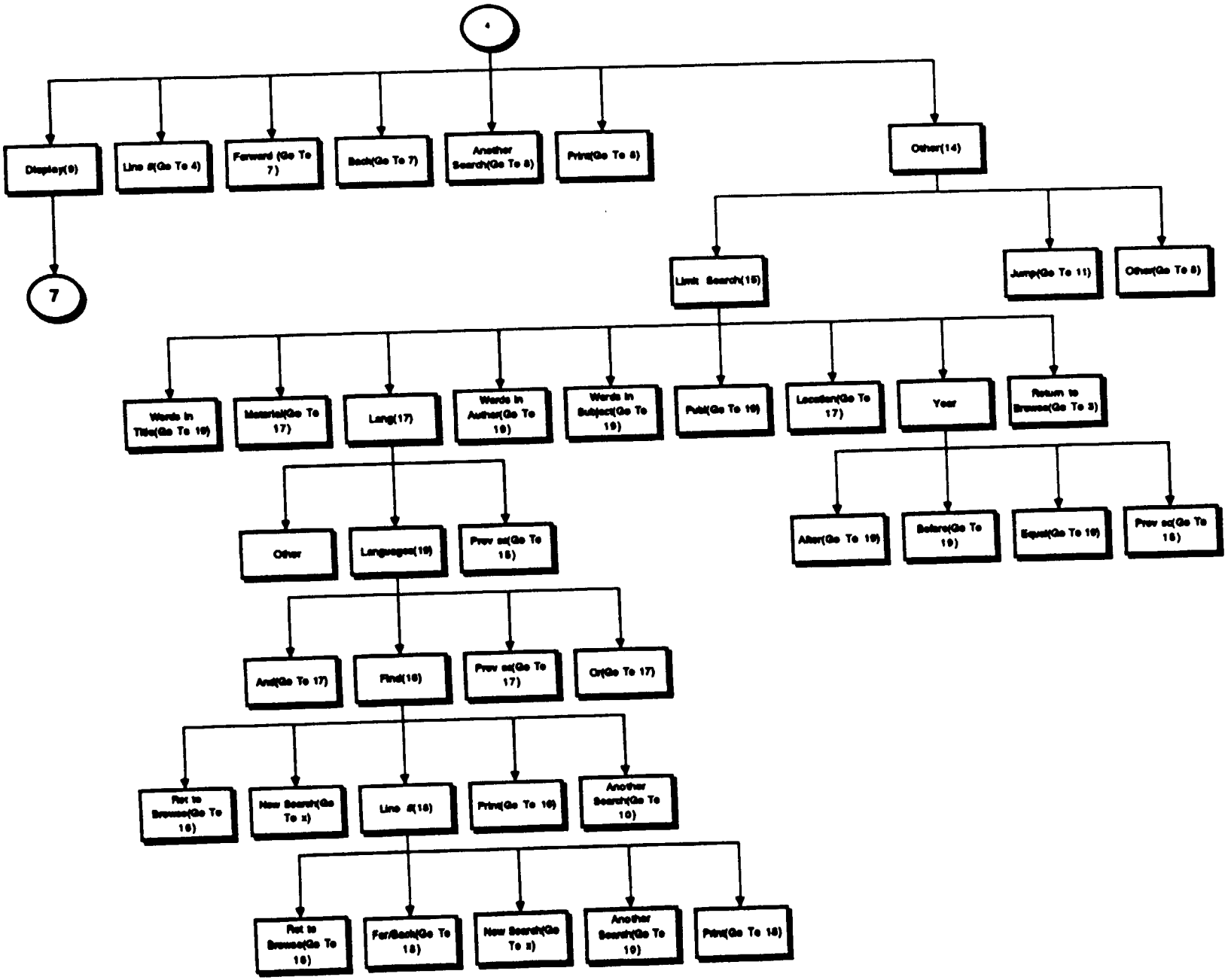
UNLV - 3


Quit(Go To 4)
For/Back(Go To 21)
Jump(Go To 11)
Display(20)
Print(Go To 21)
Quit(Go To 22)
Line #(Go To 20)
Sort(Go To 20)
Location(Go To 20)
Print(Go To 20)
Return to Browse(Go To 21)
Quit(Go To 22)

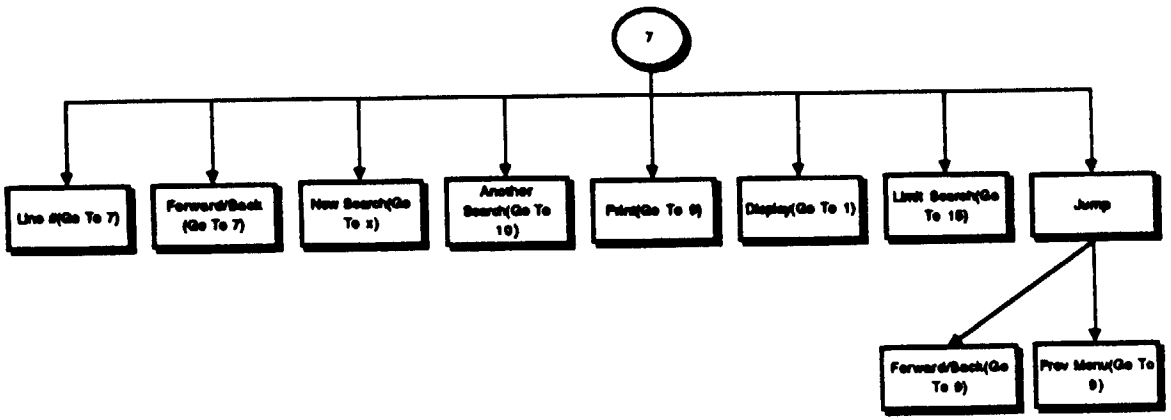


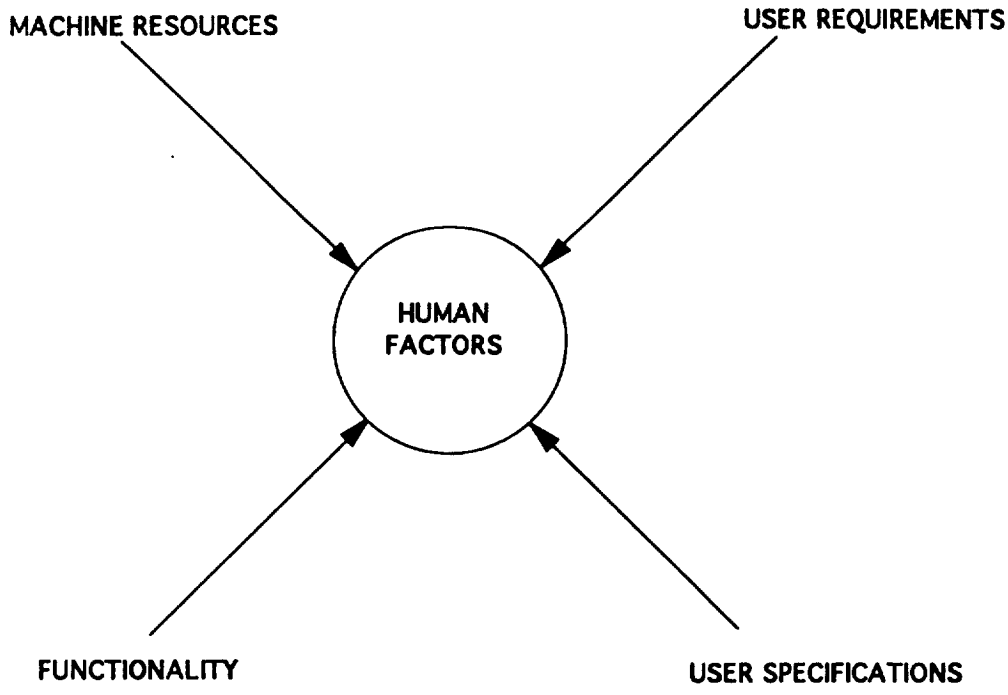

Line #(Go To 6)
For/Back(Go To 7)
New Search(Go To x)
Another Search(Go To 10)
Print(Go To 8)
Display Call #(Go To 1)
Jump(11)
For/Back(Go To 8)
Prev menu(Go To 8)


Line #(13)
Rst to Browse(Go To 1)
For/Back(Go To 7)
New Search(Go To x)
Another Search(Go To 10)
Redisplay(Go To 7)
For/Back(Go To 9)
Prev menu(Go To 9)



UNLV - 7


7
Line #(Go To 7)
Forward/Back (Go To 7)
New Search(Go To x)
Another Search(Go To 10)
Print(Go To 9)
Display(Go To 1)
Limit Search(Go To 15)
Jump
Forward/Back(Go To 9)
Prev Menu(Go To 9)


MACHINE RESOURCES
USER REQUIREMENTS
HUMAN
FACTORS
FUNCTIONALITY
USER SPECIFICATIONS

Biography

Sue Casey is Lecturer in Computer Education and Cognitive Systems at the University of North Texas. She is currently a student in the Interdisciplinary Ph.D. in Information Science at the University of North Texas where she previously received an MS. Her current areas of interest include NREN, Internet and statewide educational networks such as TENET.

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Development of the Ideal Online Catalog System

As a result of the development of microcomputer and database technologies, much effort has been spent in trying to develop a consistent human computer interface design. An increasing number of new and infrequent users try out online card catalogs, expecting to feed in their queries and get what they want in the blink of an eye. All too often their efforts meet with indifferent success. Why has the online card catalog, which everyone agrees is the wave of the future, had mixed success in meeting the needs of the library user? Unfortunately, different vendors and producers of different databases have made their own determinations about what the interface should be, based upon their individual system's database features and their own individual user studies (Rosen, 1990). This has resulted in much inconsistency among systems, and has caused much confusion for users changing from one system to another. The possibility of having a standard interface for all users has been discussed for several years (Bill, 1988; Fokker, 1989; Grudin, 1989; Birth, 1990; Batista,1992). All agreed that user interface design must be determined by user studies and the features of databases. But they also generally agreed that the interface that suits all users does not now exist. However, some general principles have emerged that meet the minimum requirements for an ideal system.

Two problems arise in setting up these minimum standards for an ideal system. The first problem is that people look at a "standard" system as being inflexible. They feel that a "standard" system with authoritative, mandated rules would be unrealistic and would hinder innovative software design (C-D Cinc, 1992; Grudin, 1989). The reply to this argument is that an ideal system would take advantage of user surveys, system

requirements and interface guidelines to allow the individual user to conduct his information search in the shortest possible time and with the least amount of effort (Stewart, 1992). The other problem is that each user has an opinion of an ideal system, based upon individual experience, perspectives, expectations, and preferences. As a result, no two users would choose exactly the same features if they were designing their own system. The solution to this problem is to outline general features of the system rather than specific ones.

There are several general guidelines for an automated online catalog. The first of these is adaptability to different user groups (Sutcliffe). Users are generally divided into three groups: novices, skillful users, and professionals. In public libraries the majority of users would be occasional users of varying ages and educational backgrounds. They would be considered mostly novice users. In the college, university, or research library the users would be more educated, more skilled with computers, and more frequent users. They would be considered frequent users. Librarians and library or research staff, who use the online computer catalogs frequently in their work, are mostly professional users. Designing a system for any one of these groups would be fairly simple, but a system must accommodate all three groups, because some combination of all these groups uses a system. As a result, each system must accommodate all three levels of users.

A second guideline is the purpose of the system. The functions needed in the system, the amount of the information in the database, and the number of users served by the system are all important considerations. A small public library will have different requirements than a large university library. A small specialized business or law

library will have different needs than a public library. A simple online catalog will have different needs than a full-fledged system handling circulation and serials as well. These considerations must be dealt with when deciding on the design of a system.

The final guideline is hardware constraints placed upon the system design. The system may be limited by the available hardware on hand or by cost factors. The system may also be affected by limitations in hardware design. On the other hand, if starting a system from scratch, the hardware must be powerful enough to perform all the functions the system needs to perform, and also have room for growth of the system in users and materials. Finally, some advanced features and user friendly designs require more storage space and faster running speeds. These hardware considerations figure in system design.

In addition to general system guidelines, there are human computer interface considerations to be dealt with (Brown, 1988). Some rules of thumb in considering human computer interface are:

1. Reduce amount of memorization of commands, codes, syntax and rules required of the user.

2. Reduce the amount of mental manipulation of data required of the user. Present data messages and prompts in clear and directly useable form.

3. Reduce requirements for the user to enter data. Structure the interaction so that manual user entries are minimized . Selecting from displayed lists is preferred to entering choices manually.

4. Provide computer aids to reduce the amount of mental processing required of the user to remember and execute complex procedures with many steps.

5. Use computer algorithms to pre-process complex, multi-source data and present a composite, integrated view of complex patterns of relationships among many variables.

Following the above human computer interface guidelines should help produce a system the user can use with ease and confidence.

Since the system being designed is an online public access catalog, library information to be included should also be a consideration. For library online catalogs, Joseph Matthews (1987) conducted research on the display method. The research showed that a display providing the following elements would satisfy over 97% of users.

- Author
- Title, subtitle
- Uniform title
- Subject headings
- Added entries
- Volume number, volume title
- Edition statement
- Date of publication
- Edition and publishing history note
- References
- ISBN or other control numbers

Obviously a display containing these features would satisfy most library users, but some brief displays, such as a location screen, might not need as much information. So a library display should balance the available information with the necessary information for each display.

In discussing specifics of an ideal online catalog, several areas must be considered. These include the general areas of

guidance/instruction, menu selection, online assistance (help screens and error messages), screen design, movement within the system, search functions, and object manipulation functions. Each of these areas has many individual features to consider. The first area to consider is the features of the online catalog's guidance/instruction system.

Hierarchical Knowledge Structure

As was discussed earlier, mental and physical manipulation of data should be minimized (Brown, 1988). For this reason, the access steps of the ideal system should be organized in a hierarchical rather than a horizontal structure. This means having a step-by-step approach to retrieving materials. It is an especially good system for novice users, as it allows them to use the system easily while learning it.

Novice/Advanced Manipulation

The system should be able to provide different layers of help to meet the needs of both the novice and advanced user. That should provide efficient help for both sets of users. It should also allow both simple and advanced data manipulation so that both novices and experts can work at the pace best suited to them.

Process Acknowledgements

A screen message should tell users when the computer is working on their request. Without this message, users may start to wonder if the computer received their message, especially if the processing takes several seconds. This feature is especially useful to the novice user.

Screen Setup

Being able to reconfigure the screen to the users' wishes is a good feature for an ideal system. It allows the user to control the appearance

of the screen and to arrange the materials in the most useful fashion for the work being done.

Sensible Defaults

Whenever the user fails to specify a selection, the system should be able to intelligently chose the option that is most frequently selected based on previous use. This feature may be especially useful to the novice user who is unsure and slow in using the system.

These instructional/guidance features are important to the overall operation of the system because they set the tone for the user's interaction with the system. But other features are also important in using an online catalog system. One of these is menu selection.

A menu is a list of options from which a selection or selections can be made by the user. It provides the user an explicit list of available options, permitting selection by recognition rather than requiring recall. Menus provide a useful technique to make computer systems more accessible to novice users, less demanding on the memory of infrequent users, and , if properly designed, more efficient even for experienced users. The following features might be important for a menu driven catalog system.

Menu Order

The items in a menu should be listed in an appropriate order. In a library catalog, the functionally related items should be arranged together, with the most critical item listed first, the most often used items next, and with everything in a logical sequence.

Consistent Layout

The same information should appear in the same place on the screen as the user works through the system. This gives the user a feeling of

continuity when using the system and saves time, because the user doesn't have to become familiar with the screen again each time it changes.

Consistent Terms

The menu should contain the same terms for each action or function on each screen. This allows the user to learn the system more quickly, reduces errors, and makes the system easier to use.

Full Command or Simple Selection

The user should have several methods of menu selection. Full command terms, a single letter representing a command, or the number of the command in the menu list are all appropriate menu selection options. HIghlighting the appropriate menu item and then pressing the enter key is another acceptable method of menu selection.

Exiting the Menu

Sometimes the user gets a menu by mistake. When this happens, there should be a way to exit that menu without starting the search again. The best way to solve this problem is to have a proper exit message on each menu screen, and to differentiate between going back one screen, going back and starting over, and logging off the system.

It is obvious that the menu is very important to the online catalog system's operation. Online assistance, the use of help screens and error messages, is also very important to the working of the system.

Connection of Help Screen to System

System commands should be entered directly from the help screen once the proper command is determined. The user should not have to exit the help screen before returning to the system.

Global Help

Global help, or having the same help messages listed each time help is requested, is not a good choice for the ideal system. This method requires the user to read through all the help messages to find the one that applies to him. If the help messages are very detailed, it could also take several screens to hold them. A general help screen, available at the beginning of the search, is not the same thing as global help, and this general help is very useful.

Context Specific Help

Context specific help, or help directly addressed to the problem the user is facing at the current time, is the best method of help for a system to use. This help should be related to the process or screen the user is currently involved with, and it should have the specific steps for the user to take to resolve the problem.

Layered Help

Layered help is help that is tailored to the point in the system where the user is located. For example, the help screen at the beginning of a search might tell how to conduct an author, title, or subject search. After performing a search and receiving 200 entries, the help screen might tell how to limit the search or select from the many responses. There might be a second screen as well, if more detailed information was needed by the user than that given on the first screen.

A help screen is designed for the user to call up when a question about the system or the search occurs. This is information the user is asking for directly. Error messages are help that the system gives the user, and they are a response to incorrect input by the user. As such, they are different from help screens.

Error Messages

An error message is the system's response to an invalid or failed search. The error message should not only indicate the invalid input, but also point the user toward a valid one. If possible, the error message should give a specific diagnosis and a suggested solution to the user's invalid input. The error message should also be non judgmental in tone, as the user feels bad enough about the failed search without the error message rubbing it in.

Online assistance, whether in the form of help screens or error messages, should be in plain, simple phrases or sentences that are short and to the point. This reduces the chance of further error and of misunderstanding on the part of the user.

Screen design is also an important part of the online catalog system. It can make it easy or difficult for the user to find information, and make reading the screens tiring or relaxing. There are several important features to consider in screen design.

Bold Lettering

The system presents specific words, phrases, or commands in contrast to surrounding characters. This makes these words stand out, and is an excellent way to highlight important information.

Case Sensitivity

Upper and lower case letters execute different commands in the system. This is probably not a desirable feature in a system, because changing from to upper to lower case letters and back again is distracting. In addition, if the system has so many different commands that upper and lower case lettering is needed to get them all in, then the system is probably too complicated.

Clutter

Sometimes too much information is provided on a single screen. This condition is called screen clutter. To avoid screen clutter, information should be ordered in windows and layers, and care should be taken to see that only essential information and information that is related to the user's search is included in the screen design.

Command Line/Menu Bar

Each screen should have either an area for user input, or selection of an item by highlighting it with cursor keys. An ideal system might even incorporate both, using one method for novices and having the other available for expert users.

Full Screen

Full screen editing should be available for the user, rather than his being able to only change the line he is working on. This feature is very desirable for the user. Single line editing restricts the user and makes searching more tedious.

Reverse Video

Reverse video is the presentation of specific words, phrases, and commands in background intensity. This is a good method for highlighting important information and is especially useful for the novice user.

Screen Refresh

Screen refresh means that the screen's characters are cleared before the next screen's input is displayed. It also refers to the screen going back to an initial screen if no action is taken after a specific length of time. This lets a new user know that the terminal is available for use if the previous user doesn't log off, and prevents his having to log off for the previous user.

Text Layout

Text layout refers to the useful organization of text as opposed to simple display of the text with wrap around. Text layout can influence how well the user is able to find information, as well as making the system more comfortable.

Screen design is an important function of the online catalog system. But as important as the design of the screen is the ability to move from screen to screen within the system. The following features are important in moving back and forth within the system.

Global Access

Global access allows the user to invoke any command available from anywhere in the system. It gives the user the freedom to start a new search or end an on going search at any time. It is important for frequent and expert users.

Restart

This is the ability of users to end a search at any level and to go back to the beginning screen. Obviously if the system has global access it has this feature, but if global access is not available in a system, this feature should be available.

Logout

The system should either recognize all regularly used logout commands, or it should provide the logout command on every screen. The system should be set up so that the user can logout from every screen.

Next Screen/Previous Screen

The ability to go forward or backward a screen at a time is very important to a system, especially when the user is in the record display. It allows the user to back up a screen without starting over if he makes a mistake in entering a command. It also lets the user go through the record

display without calling up each record individually.

The above methods of moving within the online catalog are important to its efficient functioning, but just as important are the individual search functions. Some of the more important search functions are mentioned below.

Adjacent Matching

In performing a Boolean search, the user should be able to limit matches to within the same sentence or within a certain number of words of each other. This feature should prevent pulling up matches which occur only accidentally and are not really linked.

Boolean Searching

Use of "and" "not" "or" combinations in multiple search requests allows pairing of words such as "recruitment and retention" of workers, separation of words such "black not hispanic" minorities, and inclusion of words such "Japanese or German" luxury cars. This capability enables the searcher either to limit the search to specific items , or to expand the search to include all possible items of relevance.

Browse

The ability to browse through a list or group of items associated to the initial screen query can be very helpful (Lyons,). Closely related subject headings may give the user an idea for another search. Scanning author entries close to the one entered may turn up entries which were misspelled or which left out a middle name or dates of birth or death.

Query Control

The ability to display a record of previous queries can be very important in refining and executing a complete search. This list of

previous queries should also list the number of responses the system found with each search. Checking previous queries allows the searcher to insure tha terms haven't been left out, and can provide ideas for adding related terms to the search or combining terms to limit the number of responses.

Closest Ranking

Closest ranking, entering an index or list at the closest possible place to the word entered when there is no exact match, is a preferred way to catch things such as misspelling or use of a plural search term when a singular should be used. This function is much like the browse function except that it automatically appears on the screen when the search term is entered.

Vector Product Ranking

Help needed.

Limit after Retrieval

When a query returns an unusually large number of responses, it is very useful to be able to limit the search without having to start over. This can be done in several ways: another term might be added (Boolean searching); an author's first name might be added; or a title might be added to an author search. When this feature is available, and it should be, the possible options available to the searcher should be shown on the same screen that lists the responses.

Positional Matching

Restricting matches to specific indexes, such as author, title, or subject prevents entering an author search and listing all the books about the author as well as books the author wrote. This option should be

available when doing keyword or Boolean searches, since an author, title, or subject search automatically takes of care positional matching.

Search

If computer power is not a limiting factor, the computer should be able to take search terms and both find them in an index and search full text to retrieve all matches. Being capable of performing both types of searches allows the searcher much more flexibility in finding the desired information sought and may allow the retrievor to find information missed in only an author, title or subject search.

Similar Topic

A similar topic search should allow the searcher to look for similar items to the ones found, regardless of how the first item was found. The searcher may have found the first item by title, but want other books about the same subject. He or she may have searched by title, but want other books by the same author. Either way, the searcher should be able to change from one type of search to another without having to end the search and start over.

Store Searches

While performing a computer search, the user should be able to store prior searches for later review. This can insure that all terms have been searched and all combinations have been tried.Results may be reviewed in order to revise search strategies and increase or decrease responses to the successful searches.

Stopword

The ideal computer system should have a stopword that can terminate a search at any point. Some systems are unwieldy because the searcher gets to a certain point in the system and cannot exit the search

from there. The searcher has to go on with the search, or go back to the introductory screen to start over. A system should either allow the user to either terminate the search from any point, or begin a new search from any point in the system.

Truncation

Truncation, allowing the searcher to enter only part of a word or name instead of the whole term, is a valuable searching tool. When the searcher is unsure of the spelling of a word, the first few leters of the word can be entered and the computer will pull up the records of all terms beginning with those letters. Similarly, if the searcher is unsure of the correct form of the subject heading, the first part of the term can be entered and the computer will pull up all the terms beginning with those letters.

Keyword Searching

Keyword searching, looking for a specific word in a title or subject instead of entering a Library of Congress subject heading, is a very desirable search characteristic (Olsen, 1989). It allows a search when the user doesn't know the correct search term and no copy of the Library Of Congress Subjejct Headings (LCSH) are around. LSCH headings are the "official" headings assigned by the Library of Congress and used as subject headings in library catalogs. Keyword searching also allows use of common terminology rather than technical terms in searching for information on a subject. In systems where both subject and keyword searching are available, keyword searching seems to be as effective as subject searching.

Undo Current Query

One of the most desirable features a search system can have is the ability to change or cancel a query. This function allows a searcher to redefine an unsuccessful search, or to back out of screen. It also lets the searcher experiment with features of an unfamiliar system without worrying about losing the search (Kaplan, 1990).

Bridge

A Bridge or communication link to other systems is very helpful. It allows the searcher to access other systems without logging off the current one. The user may be able to check for electronic mail, log onto another library system, make a request for a book on interlibrary loan, or do a variety of other tasks without logging off the system each time.

The functions listed above should be available in the ideal search system. These functions allow the experienced searcher to make better use of the system, and many of them are also of use to the novice. In addition to these individual features, there are several manipulation functions that should be available in a search system.

Brief/Full Record

The searcher should have a choice between a simplified and detailed record. If the searcher is only interested in whether or not a book is available, all the bibliographical information doesn't have to be displayed .

Page Up/Down

The ability to move up or down one screen at a time allows the searcher to rapidly scan lists of titles or subjects in search of the exact term or book. If the searcher is in a list, this function should also allow movement with in the list, much like the browse function discussed above.

Scrolling

Scrolling allows the searcher to move the screen one line at a time as text is read. This is beneficial if the searcher is reading a long message of more than one screen because he can read to the bottom of the screen and then just call up each line, instead of paging up and having to find the place again. It also allows the searcher to go back a line or two to reread a sentence.

Top/Bottom

Using specific keys to move to the beginning or end of a page or file is an important function. It allows the user to go to the beginning or end of a list without scrolling or paging up or down, thus saving search time.

Type-In Matching

Type-in matching is the ability to choose a menu item by typing in the first few letters of the menu item instead of the whole term. Using just the first few letters saves time in the search and reduces the chance of a typing error.

Print

Any search system should have the ability to print out the results of the search. Printing out the results keeps the searcher from having to write them out, a time-consuming process that often results in leaving out information or putting it down incorrectly. It also gives the information in the correct bibliographical form. The ideal system should also be capable of downloading information to other files or onto a disk.

The object of the functions and screen manipulations described above is to make it easier and faster for the user to find the desired information, as well as insuring all possible matches. Reliability and response time are two of the most important factors in judging a system's

performance (Salmon, 1988). The system should also improve upon the manual process (Heinemann, 1985). Integrating these functions into a system should create the perfect search system.

Annotated Bibliography.

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Abstract: Two articles describe the experiences of Loyola University of Chicago and Texas A & M libraries with locally mounted online databases under the same user interface as the online catalog. The Multiple Database Access System (MDAS) offered by NOTIS is explained, its impact on the libraries is described, and student and faculty reactions are reported.

Beecher, Henry. (1990). "Public access workstations in the library: new trends." *Wilson Library Bulletin*. 65(6):52-53.

Abstract: In libraries, as in the PC industry at large, the designation "workstation" has been applied to everything from a PC acting as a front-end terminal on a mainframe to a stand alone microcomputer used to do online searching. This paper talks about the new trends in library from three facets: the ideal workstation, full-text access, and need for standards.

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Booth, Paul A. (1989). *An Introduction to Human-Computer Interaction*. East Sussex, UK: Lawrence Erlbaum.

Abstract: Human-computer interaction is characterized as consisting of five major areas of study: research into interactional hardware and software, research into matching models, research at the task level, research into design and development, and research into organizational impact. This book discusses these areas in detail and provides many readable materials and practical guidelines.

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Abstract: This book is a set of practical suggestions and guidelines to aid designers of the interface between computer systems and their users. Many of these guidelines have been developed from expert judgement, common sense, practical experience, and basic theories and principles of cognitive psychology and ergonomic design. In this book, some general concepts are discussed, many guidelines are listed, including examples to contrast observing the guideline with violating it. In further, a strategy is presented for implementing human-computer interface design principals in the development of a product.

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Abstract: A microcomputer based user interface was developed and programmed for the library computer systems at the University of Illinois. Designed to provide user friendly access to the two components of the online catalog on the library's IMB 3081 mainframe, the interface program resides on the IBM PC and queries the user in natural written English. The implementation and problems of screen layout, natural language queries, subject searches, and computer programming are discussed in detail.

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Abstract: Any online catalog requires hundreds of design decisions and raises hundreds of questions. Many of these decisions and questions revolve around the way bibliographic records are displayed. How should bibliographic records be displayed? How many different displays should an online catalog provide? As libraries convert from card catalogs to online catalogs as the primary or only source of bibliographic information, the questions become more crucial and the answers must become more refined. Future online catalog design should benefit from the successes and failures of the past and present, and such designs should be able to build on a growing body of research into online catalog design. This book is one contribution to that body of research, focusing on these questions. This book provides some answers to the questions of single-screen display, based on large scale controlled experiments using current bibliographic data.

Crawford, Walt. (1988). "Common sense and user interfaces: issues beyond the keyboard." *Library Hi Tech.* 6(2):2-7.

Abstract: Discuss issues relating to microcomputer software user interfaces: (1) accessibility; (2) ease of learning vs. speed and flexibility; (3) arrogant vs. accommodating software; (4) file management capabilities; and (5) subdirectories, and bad text.

Crawford, Walt. (1987). *Patron Access: Issues for Online Catalogs.* White Plains, NY: Knowledge Industry Publications.

Abstract: This book presents an exhaustive survey of dozens of aspects of online catalogs, including global issues such as starting and stopping points for online sessions; printers, workstations and other peripheral devices; command methodology; and retrieval and browsing.

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Abstract: This checklist is a compendium of features compiled from Requests for Proposals prepared by several libraries which have been submitted to IBM's DOBIS/Leuven system. Topics highlighted include: major functions, general considerations, cataloging and OPAC, circulation control, acquisitions, serials control, and interlibrary loan.

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Abstract: Computer software must be designed from the user's viewpoint and tested with potential users to ensure that they can readily make it work. Designers of software and its users communicate through the interface to the software. Designers who already realize this have taken the first step toward creating better products. This book concerns with the following components: the words and symbols on screen, the content and layout of displays, the storage and display procedures, and interface organizational structures. The goal of this book is to help designers to create better and more effective user interfaces.

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Abstract: A descriptive study was conducted to delineate a structured representation of one abstract type and suggest how this predictable representation could affect user-system interfaces of information retrieval systems. Fifty-five argumentative type abstracts were selected from issues of "International Political Science Abstracts." Each abstract was classified into one of three groups: Substantive, Authoritative, or Motivational. Each abstract was examined for the presence of the first and the second triads of elements. It is concluded that patterns of form and structure can be found in the argumentation texts, and therefore, that the rhetorical structure of argument is a useful framework in which to describe the structure of theoretical abstracts.

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Abstract: Addresses issues involved in implementing out-dial program at Pennsylvania State University Libraries, where the feasibility of using online catalog terminals to access external databases is undergoing evaluation. Placement of terminals and microcomputers, "ready reference" searching, venders, training, cost-effective searching, advantages of out-dial, and direct patron access are discussed.

Gould, J. D. and Lewis, C. H. (1985). "Designing for usability-key principles and what designers think." *Communications of ACM.* 28(3):300-311.

Abstract: The authors provide four principles for designing usable systems. These principles are that the designers must know who the intended users of the systems are, a panel of users must work with the design team, the design must produce prototypes, and problems found during usability testing must be rectified. Once again, this paper advocates interactive design, and by way of assessing how likely it is that this sort of design might be adopted. Meanwhile, the authors describe some of the designers' attitudes towards their four principles.

Harrell, Thomas H. (1987). *Designing User-Computer Dialogues: Basic Principles and Guidelines.* Paper presented at the Annual Meeting of the American Psychological Association (New York, NY, Aug. 28-sept.. 1, 1987).

Abstract: This discussion of the design of computerized psychological assessment or testing instruments stresses the importance of the well-designed computer-user interface. The principles underlying the three main functional elements of computer-user dialogue, data entry, data display, and sequential control are discussed, and basic guidelines derived from these principles are provided. Finally, the future direction of interface design is considered.

Hathaway, Michael D. (1984). "Variables of computer screens and how they affect learning." *Educational Technology.* 24(1):7-11.

Abstract: This paper reviews the research findings on variables in computer screen displays and their effects on learning for use by designers of computer systems for instructional purpose. The author defines learning for the purposes of this study as "the learner's attention, retention, and accuracy of response, and how these are affected by fatigue." This paper emphasizes that there is a specific relationship between the components of a computer system.

The variables discussed in terms of the components include fatigue, density of displayed text, scrolling, upper case vs. both cases lettering, letter size, and graphics.

Hegarty, Kevin. (1988). "The compact disk circulation system interface at the Tacoma Public Library: beyond stand alone CD-ROM." *Library Hi Tech.* 6(3):103-111.

Abstract: Describes the development of a CD-ROM public access catalog (CD-PAC) circulation system interface at the Tacoma Public Library. Cost considerations, advantages and disadvantages, access time, and currency of the CD-PAC are discussed. This paper also discusses the issues of CD-ROM and the library market, future technologies, and comparisons of prices for CD-ROM and print equivalents.

Henry, Helen K. (1991). "Human-computer interfaces and OPACs: introductory thoughts related to INNOPAC." *Library Hi Tech.* 9(2):63-68.

Abstract: Interfaces, often referred to as gateways or front end, are software and hardware that strive to make information systems more effective and usable. The current trend is to design more intelligent systems to improve system performance and usability for a wider spectrum of user needs and skill levels to make systems sufficiently powerful and flexible while maintaining their usability. This article briefly describes human-computer interfaces and the fundamentals of good human-computer communication. The concepts are used as the criteria for evaluating the benefits and shortcomings of San Diego State University Library's INNOPAC, the PAC.

Jenkins, Darrell L. (1989). *Every One Wants One ... A Slightly Different One: The Process of Introducing a User Interface System into an Online Public Access Catalog Network.* Paper presented at the Mid-Year Conference of the American Society for Information Science (San Diego, CA, May 21-24, 1989).

Abstract: The development, testing, introduction, evaluation, and refinement of a user interface for a state-wide, multi-library online public access catalog network can be a very involved and politically complex enterprise. Online network system must be developed through three way interaction among users, library staff, and the systems designer, not simply by the designer for the librarians.

Jones, Richard M. (1989). "Online catalog research in Europe." *Journal of the American Society for Information Science.* 40(3):153-157.

Abstract: Describes online catalog research being conducted in Europe in the areas of interaction and interface design, subject access, functional improvement through the application of information retrieval techniques, and library networks. Three operational online catalogs, not available outside Europe, are discussed also.

Kaplan, Denise. (1990). "Online user assistance: a symposium." *Library Hi Tech.* 8(1):65-84.

Abstract: Most second generation online catalogs give libraries some capability to customize help messages, screen displays, and system prompts. The librarian has become an active, if not always willing, participant in the design of the system's user interface. Knowledge of both patrons and collections can have direct bearing on the library's automated systems. The guidelines presented in this paper are generally applicable to all online user assistance.

Lancaster, F. W. (1987, Ed.). *What Is User Friendly? Papers presented at the Clinic on Library Applications of Data Processing.* Papers presented at the 1985 conference.

Abstract: The papers in this proceedings consider ways in which user friendly interface design may be used to make online systems in public and academic libraries easier to use, and thus more attractive to potential users.

Lynch, Clifford A. (1988). "Response time measurement and performance analysis in public access information retrieval systems." *Information Technology and Libraries.* 7(2):177-183.

Abstract: This paper discusses both measurement of response time and related performance data in large, interactive, public access information retrieval systems. Three basic data types of performance measurement can be used in four major areas. The key measurement is response time as perceived by the user. This is the best measured by an external system that actually emulates a human being at a terminal.

Lyons, Evelyn. (1987). "Onsite observations of automated library systems: a checklist to aid the automation observer." *College & Research Library News.* 10(11):609-612.

Abstract: To design a library automation system for better use, a checklist on the relevant issues and features is developed. This checklist consists of general information, planning phase, vender relationship, systems operation, databases, and capabilities and features.

Markey, Karen. (1984). "Offline and online user assistance for online catalog searchers." *Online*. 8(3):54-66.

Abstract: Discusses online public access catalog (OPAC) user assistance includes results of focused group interviews of 70 OPAC users at six libraries. Importance of printed materials, library staff assistance users' problems relearning OPAC searching, computer assisted instruction, multiple dialog modes, informative system error messages, and prompts for OPAC interface are highlighted.

Matthews, Joseph R. and Lawrence, Gary S. (1984). "Further analysis of the CLR online catalog project." *Information Technology and libraries*. 3(4):354-376.

Abstract: Reports on the online catalog public access project, a survey of users and nonusers in 31 US libraries conducted for the Council on Library Resources. Characteristics of users, tasks, library setting and system interface that affect user satisfaction are identified.

Matthews, Joseph R. (1987). "Suggested guidelines for screen layouts and design of online catalogs." *Library Trends*. 35(4):555-570.

Abstract: Presents detailed guidelines based on the literature for screen layout and design of online catalogs, and discusses the potential advantages in terms of number of transactions per hour and user satisfaction. Further research questions are suggested and an extensive bibliography is provided.

Mildreth, Charles R. (1986). "Communicating with online catalogs and other retrieval systems: the need for a standard command language." *Library Hi Tech*. 4(1):7-11.

Abstract: Command driven searches would be facilitated, as users move from system to system, if a common command language were used. Proposed standards for a "Common Command Language for Online, Interactive Information Retrieval" have been developed by National Information Standards Organization (NISO) Committee, and are now being reviewed for adoption.

Morrow, Blaine Victor. (1990). "In search of a standard for CD-ROM retrieval." *CD-ROM Librarian.* 5(3):12-16.

Abstract: Explains that the standard is necessary for CD-ROM industry by looking at the standards that do exist, the issues involved in proposing and adhering to standards for retrieval engines for CD-ROM, and how retrieval software fits into the total picture of CD-ROM development and implementation.

Norman, D. A. (1983). "Design principles for human-computer interfaces." *Human Factors in Computer Systems: Proceedings of the CHI '83 Conference, Boston.* Amsterdam: North-Holland.

Abstract: The author suggests four principles for Proving designs. This paper is not directly concerned with providing design principles, but is aimed at guiding others who might wish to provide these principles.

Nye, Julie Blume. (1988). "User interaction with the authority structure of the online catalog: results of a survey." *Information Technology and Libraries.* 7(3):313-316.

Abstract: Describes a survey that examined ways in which users interacted with the authority control of online catalogs developed commercially and locally. The two types of system are compared in terms of displayed messages related to authority control and system capabilities to aid users in understanding the relationships between headings.

Peters, Paul Evan. (1988) "A framework for the development of performance measurement standards." *Information Technology and Libraries.* 7(2):193-197.

Abstract: There are three major concerns of system evaluation: functional evaluation, economic evaluation, and performance evaluation. Performance measurement is a special case of performance evaluation. Performance measurement has three different types: absolutely, comparative, and diagnostic. In the library automation system workplace study, a current trend is that performance evaluation is becoming more and more concerned.

Pogrow, Stanley. (1985). "Administrative uses of computers: what is the ideal system? what are the trends?" *NASSR Bulletin.* 60(485):45-53.

Abstract: Presents an outline for the ideal computer system for schools from a management point of view. Includes a discussion

of new trends in the design and implementation of computerized management systems.

Puttapithakporn, Somporn. (1990) "Interface design and user problems and errors: a case study of novice searchers." *RQ*. 30(2):195-204.

Abstract: Identifies problems that undergraduate searchers encountered in a search of the ERIC database on CD-ROM. Results of participant observation, questionnaires, and interviews are reported; a taxonomy of user problems is proposed that includes syntactic errors and semantic errors; and recommendations for menu selection systems, online help, and training programs are offered.

Salmon, Stephen R. (1988). "Measuring system performance: the vendor's perspective." *Information Technology and Libraries*. 7(2):185-193.

Abstract: This paper reviews the system performance measurement for Carlyle system at Boston University at vendor's viewpoint. During that test, response time, transaction load, ability to handle database and terminals, and system reliability were measured. The relevant benchmark tests also were reviewed.

Schmidt, James G. and Pobuda, Michael. (1988). "Capacity modeling at RLG." *Information technology and Libraries*. 7(2):173-177.

Abstract: A set of steps is used for a capacity modeling at RLG. Types of activity and types of resources of the system are considered at first. To measure the current level of utilization is very important for capacity modeling. The system future use and the future needs for the system also be developed.

Shneiderman, Ben. (1987). *Designing the User Interface: Strategies for Effective Human-Computer Interaction.* Addison-Wesley.

Abstract: Provides a broad survey of the issues in designing, implementing, managing, maintaining, and refining the user interface of interactive systems. This book also presents design issues, experimental evidence, and reasonable recommendations. The author's goal is to encourage grater attention to the user interface and to help to develop a more rigorous science of user interface design.

Steward, Mary R. (1992). "Users, standards, and access: in search of the standard user." *CD-ROM Librarian.* 7(2):10-17.

Abstract: The success of a user interface requires basing the design on a sufficient understanding of user behavior. This article focuses on the need for accurate observations of library user behavior before developing standards. One can not open a library or computer publication nowadays without reading about standards, but we have no "standard" user. We could be wise to pursuer a goal of creating a set of standards for the user interface that are based on the observation of user behaviors.

Sutcliffe, A. G. and McDermott, M. (1991). "Integrating methods of human-computer interface design with structured systems development." *Man-Machine Studies.* 34(3):631-655.

Abstract: Various methods for specification and design of the human-computer interface have been proposed but not been wide spread. Possible reasons for this may be the lack of integration of human-computer interface design with software engineering and the specialized nature of HCI methods. A method of interface design is proposed which integrates the development of the human-computer interface with structured systems analysis and design. The method covers task and user analysis, interface specification and dialogue design. A case study of a library system is used to illustrate the method which is discussed in relation to different approaches that have been adopted for interface specification and design.

Tague, Jean and Schultz, Ryan. (1989). "Evaluation of the user interface in an information retrieval system: a model." *Information Processing and Management.* 25(4):377-389.

Abstract: Presents an evaluation model that is appropriate to the assessment of the effect, from the perspective of the user, of variations in the interface to an information retrieval system. The application of the model to the evaluation of an experimental online catalog is described.

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Dr. Rovig

Outline of the Chapter "The Ideal System"

Wei He
March 13

I. Concepts:

With the development of technology, the human-machine interaction is becoming more and more important. Consistent interface, Standard interface, and Ideal system are the concepts we need to get very straight just for our convenience of further discussion. Some concerns are:

1. Relative Judgement: There is no absolutely ideal system. Every designer, user, and observer has individual, different opinion about the good interface. Up to now, the argument about if we need a model system is still undergoing fervently. Therefore, it is wise we not use the term "standard." Instead, an ideal system is good for some user groups.

2. Defining "IDEAL": Four overall estimates and two technical requirements. All are conceptual.

1) Adaptive to different user groups: the system is designed with several level of complex of interface so that users are able to choose the most convenient one by how well they are familiar with the system.

2) Effective and Efficient: the system interface not only accomplishes the task required, but also does it through a least cost way. Efficient consideration includes the elimination of unrelated stuff. The database interface must only be task-sufficient.

3) Consistency/Standard: the idea of the interface, the flow of the search path, and the terms for menu selection or the terms of command must be in the same sequence. "Standard" here means referring to and consistent with the previous authoritative works.

4) Intuitive: the concept has been very vague. It means users do a search in a natural way. The interface leads users step by step to the target with not feeling frustrated and awkward. It also means that the search is not interrupted by frequently checking help messages.

5) Navigability: the technical requirement mentioned a lot in "Screen Design."

6) Readability: it refers both the word choice and the text layout.

II. Situation of Interface Consistency Movement

1. Efforts on Common Command Language - NISO, Common Command Language for Online Interactive Information Retrieval, 1991.

2. Efforts on CD-ROM product interface - CD-CINC, CD-ROM Consistent Interface Guidelines: A Final Report, 1992.

3. Online Public Access System - none. We are working on this. The system not only includes library catalogues, but also many other databases like campus info, job vacancies.

III. A Scenario of an Ideal System:

1. Compromise of user groups and efficiency: Examine and determine the user groups. Then, make the decision on what should be included in and what should be excluded from the interface design.

2. Balance of standard and innovative: This is the traditional topic - Standard setting may hinder the innovative design. What the CD-CINC people are doing is to set up the conceptual rules instead of the physical format. That is wise.

3. Balance of powerful and simplicity: Users, especially the novice, casual users, hope to get the search task done with minimum efforts. That requires the simplicity of the interface. However, the simplified interface may reduce the powerfulness of the database.

4. Balance of fancy and dull: Whether to use windows and sophisticated screen design or not is, again, determined by the user groups. If the users concern about the task-sufficient as major issue, the dull format, which is the direct, simplified interface, should be presented.

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Ideal Online catalog systems for Libraries and Information Centers

Hong Xia

An ideal computer system is the perfect situation of that system. It is the objective of computer system designers, owners and users.

Now, computer systems become very popular, they are used to do a lot of things. In libraries or information centers, computerized catalog system become a necessary tool. Whereas, when we using these systems, it is easy to find some functions or actions are very clumsy. For example, when a catalog system asks for a command, we can not recall anything to type in; when we want to look at the previous search screen, the system may not have that function; sometimes we are confused by the meaning of selection, for instance, what is the meaning of index in the selection "Go to index"? what is the meaning of guide list in the selection "Go to guide list"? etc. So an idea emerged in our mind, why not overcome these all shortcomings and build an "ideal" system?

1. Problems relevant to an ideal system.

It is hard to give a detailed description for an ideal system even it looks like a good idea. The concept of ideal system is limited by many conditions or by our perspectives. Before trying to determine what an ideal system will be, we should make clear several problems.

(1). What is the purpose of the system?

For a computer system, the purpose determines the necessary functions and features, so this purpose determines the meaning of "ideal".

An online catalog system will be used in a library or in an information center. If it will be used in a library, we should think about what kind of the library? It will serve for a public library, a special library, or an academic library. If this system will be used in an information center, we should consider that what kind information will be dealt with: business information, politics information, military information, or educational information?

Which database will be used? And how large in scale of our institution? etc..

(2). What is the user group?

Because of the technical limitation, to realize faster and more accurate retrieval functions the user need to have more searching skills. Our consideration of user group just based on this trade off. Usually, we divide our users into three groups: professionals, skillful users, and novices. When we start to design a new system, the user group should be considered at first.

Usually, user group related with the institution. For public libraries, the user group will be all residents in a regional area. In order to satisfy all demands of them, we prefer to consider them as novice users, the catalog system designer should aware that user friendly functions will be the most important.

For university libraries, college libraries, or research libraries, the user group could be considered as the skillful users. Because they usually have some computer knowledge, and they may use the library more frequently than public library users, they may getting familiar with the system. For these users, it is not difficult to follow on-screen instructions or online help.

For the librarians use or information agency staff use only systems, the user group is professionals. These users demand the least on user friendly, they may need some special functions or fancy features. As a trade off, user friendly can be sacrificed.

(3). What kind hardware?

Some fancy functions, features, or user friendly designs demand more storage spaces and faster running speed for the hardware. An ideal system must make a good adjustment between the functions and the hardware limitation.

(4). Ideal system is a developing concept.

Because the meaning of "ideal" based on the nowadays conditions, ideal system is a developing concept.

At first, this concept is developing with the time. An ideal system for yesterday is no more ideal for today. Two decades ago, a complete library card catalog system could be thought as an ideal system, but now we prefer to use computerized catalog. Card catalog system is not the ideal system in libraries any more. As same way, the ideal system for today will be fade by tomorrow.

Next, an ideal system is developing with the advance of technology. Computer systems have close relation with communication technology and material technology. Using satellite communication, we have international computer online search network; using LCD technology, we have laptop PC. So if there is a great development in these fields, the computer network, the CPU, and the monitor design will be changed dramatically.

At last, the ideal system is developing with the relevant theories. New theories will point out the directions for future system development and provide advance guidance for new technology.

(5). The ideal concept depends on different perspective.

From users' perspective, an ideal system should satisfy their demands and easy to use and learn. From the owners' perspective, an ideal system should be affordable and functionally to satisfy the users. While the system designers usually consider the effectiveness of a function, and how difficulty to realize a required function. So from the different perspective, there are different standards for an ideal system.

2. Bottom lines for an ideal system.

Even an ideal library online catalog system is difficult to describe, it is not hard for us to find some guidelines and standards of relevant software system design and online catalog system displays. These guidelines and standards could be considered as the bottom line of an ideal system.

For human computer interface design, we have following rules of thumb in Brown's book:

(1). Reduce the amount of memorization of commands, codes, syntax and rules required of the user.

(2). Reduce the amount of mental manipulation of data required of the user. Present data messages and prompts in clear and directly useable form.

(3). Reduce requirements for the user to enter data. Structure the interaction so that manual user entries are minimized. Selecting from displayed lists instead of entering choices manually.

(4). Provide computer aids to reduce the amount of mental processing required of the user to remember and execute complex procedures with many steps.

(5). Use computer algorithms to pre-process complex, multi-source data and present a composite, integrated view of complex patterns or relationships among many variables.

As an ideal system, it should be easy to learn and use. In order to optimizing ease of learning, ease of use and functionality, following techniques can be followed:

(1). Design for novices, intermittent, and expert users.

(2). Avoid excess functionality.

(3). Provide multiple paths.

(4). Design for future progressive evolution.

For library online catalogs, Joseph Matthews conducted a research on the display method. The result showed that a display providing the following elements would satisfy over 97% of users.

- Author names.
- Title, subtitle.
- Uniform title.
- Subject headings.
- Added entries.
- Volume number, volume title.
- Edition statement.
- Date of publication.
- Edition and publishing history note.
- References.
- ISBN or other control numbers.

Obviously, as an ideal online catalog system, these elements should be contained in the display screen.

As for the bibliographic record display method, there are three main formats: cardlike display, labeled display, and mixed display.

Cardlike display is familiar to librarians and many library users. The screen of cardlike display looks like a library card. It has a familiar context and help users to think of an online system as being merely an online card catalog. This display is the earliest format of bibliographic databases or online catalogs.

Labeled display is a kind of display with understandable, appropriately placed labels added before every identifier fields. Labeled display will require more screen spaces but it can give users more highlighted information than a simple cardlike display. Crawford's project pointed out that nearly all of the display reviewers in their project preferred the labeled display.

Mixed display only add the label ahead some preferred identifier fields, not for all. This method try to highlight the important fields for the users only.

No matter which display method is used, the following rules could be helpful to design an online catalog system.

- Display only information that the user needs to know.

- Every display should indicate how to exit from the screen.

- If a display continue over multiple screens, a screen number should be indicated.

About online catalog display, Crawford and his colleagues made a detailed study in their book.

3. Some features might be in an ideal system.

The following features might be considered as necessary in an ideal system.

(1). Features for menu selection.

A menu is a list of options from which a selection or selections can be made by the user. It provides to the user an explicit list of available options, permitting selection by recognition rather than requiring recall. Menus provide a useful technique to make computer systems more accessible to novice users, less demanding on the memory of infrequent users, and, if properly designed, more efficient even for experienced users.

Menu driven library online catalog system runs by user's on-screen menu selection. Because of the merits, this kind online system become popular in libraries.

Following features might be important for a menu driven catalog system:

- Item listed in a correct order.

In a menu, the items should be listed in an appropriate order. This order depends on the nature of the items and their typical uses. For library catalog system, we usually arrange the functionally related items listed together, most often used items listed first, most critical item listed first, and by a logical sequence of use, and such rules.

- Consistent layout.

Each screen has same menu version, so that to keep user in same track or same memory chunk. Otherwise, users might be confused by the different menu layout.

- Consistent terms.

For same function or same action, menu selection uses same term for all screen displays, so that user can understand and remember the meaning well and feel comfortable.

- Full command or simple selection.

User can perform menu selection by type in an appropriate full command, a single letter or the corresponding number, or by moving highlight bar with arrow key then press enter key.

- Leave menu without choosing an option.

Sometimes, the user gets a menu by mistake or not well considered. Therefore, provide a way for user to go out of the menu

is necessary. To perform this function well, the user should be told what does "QUIT" mean on the menu. It could have three meanings:

a. Hang up or log out.
b. Return to main menu.
c. Go back to previous screen or previous menu.

(2). Error messages.

Error handling is a critical feature of effective system design. Error correction is the way in which the computer system detects errors, indicates their occurrence to users, and permits the user to correct them.

Computer catalog system responds to all user's inputs, whether valid or invalid. An error message is the system response for an invalid input or a failed search. This message usually not only indicates the invalid input but also guides the user toward a valid one. Error messages along with help functions provide users with a safety net to catch them back on the right track from mistake or invalid input.

For an ideal system, the followings could be considered as a guideline to design error messages.

Give user a reference to the original invalid or search failed input so that the user can aware that why the input is not be correctly executed, or make a search failed.

User can perform the next action on the error message screen or the HELP screen, needn't use their short term memory or write down the correct command to go back the previous screen to execute it.

System gives a specific diagnosis and a suggested solution for a mistake or invalid input which has caused the search failed.

Use a neutral tone in an error message. Don't blame the user. Don't give user an error code only.

(3). Online assistance.

For convenience, online catalog system users prefer to use online guidance. It is a very important source to assist user recovery from errors or invalid inputs.

The followings could be guidelines for online assistance design.

For an online catalog system, the help screen should include:

a. A brief explanation of the purpose of the commands or selections.

b. Descriptions of input method and output data fields.

c. Definition of codes, commands, and abbreviations used on the screen.

In an online catalog system, online help facilities should be provided for every screen, and the help message should relate to the current process.

At lower level, user can get the global level help also.

At some situation, the system can give more detailed help by several layers. On the each layer, a title should be put on the screen.

When user request online help, the user's context screen should be able to maintain so that the user can go back to the application task again after using online help.

Write in short, complete sentences with plain English. Don't expect the user to read for a long time.

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The Perfect System

Some general characteristics emerge from the literature on ideal characteristics of automated library systems. The system has to meet the needs of various levels of users (Sutcliffe, p. 643). It also has to have adequate response time during peak use periods (Matthews, p.45). Capabilities should include author, title, subject, call number, keyword, and Boolean searching (Meyer, p. 87-88). In addition to these general guidelines, there are some specific requirements that an ideal system should have.

In performing a search, a perfect system should have these desired features.

Adjacent Matching

In performing a Boolean search, the user should be able to limit matches to within the same sentence or within a certain number of words of each other. This feature should prevent pulling up matches which occur only accidentally and are not really linked.

Boolean Searching

Use of "and" "not" "or" combinations in multiple search requests allows pairing of words such as "recruitment and retention" of workers, separation of words such "black not hispanic" minorities, and inclusion of

words such "Japanese or German" luxury cars. This capability enables the searcher either to limit the search to specific items , or to expand the search to include all possible items of relevance.

Browse

The ability to browse through a list or group of items associated to the initial screen query can be very helpful (Lyons, p. 612). Closely related subject headings may give the user an idea for another search. Scanning author entries close to the one entered may turn up entries which were misspelled or which left out a middle name or dates of birth or death.

Query Control

The ability to call up a record of previous queries can be very important in refining and executing a complete search. This list of previous queries should also list the number of responses the system found with each search. Checking previous queries allows the searcher to make sure that he hasn't left out terms, and it can give him ideas for adding related terms to the search or combining terms to limit his number of responses in a search with too many responses.

Closest Ranking

Closest ranking, entering an index or list at the closest possible

place to the word entered when there is no exact match, is a good way to catch things such as misspellings or use of a plural search term when a singular should be used. This function is much like the browse function except that it automatically comes up on the screen when the search term is entered.

Limit after Retrieval

When a query gets an unusually large number of responses, it is very useful to be able to limit the search without having to start over. This can be done in several ways. Another term might be added (Boolean searching), an author's first name might be added, or a title might be added to an author search. When this feature is available, and it should be, the possible options available to the searcher should be shown on the same screen that lists the responses.

Positional Matching

Restricting matches to specific indexes, such as author, title, or subject prevents entering an author search and getting all the books about him as well as the ones he wrote. This option should be available when doing keyword or Boolean searches, since an author, title, or subject search automatically takes of care positional matching.

Search

The computer should be able to take search terms and both find them in an index and search full text to retrieve all matches. Being capable of doing both types of searches allows the searcher much more flexibility in finding the information he seeks and may allow him to find information he would miss in only an author, title or subject search.

Similar Topic

A similar topic search should allow the searcher to look for similar items to the one he has found, no matter how he found the first item. The searcher may have found the first item by title, but want other books about the same subject. He may have searched by title, but want other books by the same author. Either way, the searcher should be able to change from one type of search to another without having to end the search and start over.

Store Searches

While performing a computer search, the user should be able to store his prior searches so that he can go back and review them. This allows him to make certain that he has searched all the terms and put together all the combinations he intended to try. It also lets him see what he has tried so that he can revise his search strategies and increase or decrease his responses to the successful searches he has already tried.

Stopword

The computer system should have a stopword that can terminate a search at any point. Some systems are unwieldy because the searcher gets to a certain point in the system and finds that he can't get out of the search from there. He either has to go on with the search, or go back to the introductory screen to start over. A system should either allow the user to teminate the search from any point, or let him begin a new search from any point in the system.

Truncation

Truncation, allowing the searcher to enter only part of a word or name instead of the whole term, is a valuable searching tool. When the searcher is unsure of the spelling of a word, he can spell out the part he is certain of and the computer will pull up the records of all terms beginning with those letters. Similarly, if the searcher is unsure of the correct form of the subject heading, he can enter only the first part of the term and the computer will pull up all the terms beginning with those letters, including the one the user is looking for.

Keyword Searching

Keyword searching, looking for a specific word in a title or subject instead of entering a Library of Congress subject heading, is a very

desirable search characteristic (Olsen, p. 132). It allows a search when the user doesn't know the correct search term and no LCSH books are around. It also allows use of common terminology rather than technical terms in searching for information on a subject. In systems where both subject and keyword searching are available, keyword searching seems to be as effective as subject searching.

Undo Current Query

One of the best features a search system can have is the ability to change or cancel a query. This function allows a searcher to redefine an unsuccessful search, or to back out of screen he accidently got into. It also lets the searcher experiment with features of the system he is unfamiliar with without worrying about losing his search (Kaplan, p.71).

Bridge

A Bridge or communication link to other systems is very helpful in a search system. It allows the searcher to access other systems without logging off the system he is on. The user may be able to check for electronic mail, log onto another library system, make a request for a book on interlibrary loan, or do a variety of other tasks without logging off the system each time.

All the functions listed above should be available in the perfect search system. These functions allow the experienced searcher to make better use of the system, and many of them are also of use to the novice. In addition to these individual features, there are several manipualtion functions that should be available in a search system.

Brief/Full Record

The searcher should have a choice between a simplified and detailed record. If the searcher is only interested in whether or not a book is in, all the bibliographic information doesn't have to be put on the screen.

Page Up/Down

The ability to move up or down one screen at a time allows the searcher to rapidly scan lists of titles or subjects in search of just the right term or book he wants. If the searcher is in a list, this function should also allow him to go backward and forward in the list to look at items he didn't enter, much like the browse function discussed above.

Scrolling

Scrolling allows the searcher to move the screen one line at a time as he reads text on the screen. This is especially helpful if the searcher is reading a message on the screen because he can read to the bottom of the screen and then just call up each line, instead of paging up and having

to find his place again. It also allows him to go back a line or two to reread a sentence he wants to review.

Top/Bottom

Using specific keys to move to the beginning or end of a page or file is an important function. It allows the user to go to the beginning or end of a list without scrolling or paging up or down, and that can save a lot of time in searching.

Type-In Matching

Type-in matching is the ability to choose a menu item by typing in the first few letters of the menu item instead of the whole term. Using just the first few letters saves time in the search and reduces the chance of a typing error.

Print

Any search system should have the ability to print out the results of the search. Printing out the results keeps the searcher from having to write them out, a time-consuming process that often results in leaving out information or putting it down incorrectly. It also gives the information in the correct bibliographic form.

The object of all the functions and screen manipulations described

above is to make it easier and faster for the user to find the information he wants, as well as make sure that he finds all possible matches. Reliabliity and response time are two of the most important factors in judging a system's performance (Salmon, p. 186). The system should also improve upon the manual process (Heinemann, p.44). Integrating these functions into a library system should create the perfect search system.